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4.1 Final publishable summary report

Executive summary

Objective: Soft materials and soft nanotechnology are generally considered as a field that will have a major impact on technological developments in the near future. Therefore, in 2011, ESMI set out to create a top-level interdisciplinary research infrastructure to serve the needs of a broad community of European soft materials researchers. By combining the most important techniques for the synthesis and investigation of soft matter with cutting edge scientific expertise through a sophisticated networking programme, the ESMI consortium intended to create a world class distributed infrastructure for transnational access, which would provide soft matter scientists with a broad choice of techniques to address their scientific objectives. Joint research activities were designed to further improve the existing infrastructure.
During its runtime, from January 2011 to December 2015, ESMI was active in three fields, as detailed below:

Transnational Access: ESMI succeeded in establishing a unique infrastructure, which allowed European researchers to synthesize novel soft matter materials, investigate them with the most advanced techniques and to explore their properties by computer simulations. About 2700 days of access to facilities and more than 120,000 Tflop-hours of computing time was distributed to the users, corresponding to almost full utilization of the planned capacity. About five percent of the resources were used by industrial projects, which is a significantly higher fraction than usually observed for large scale research infrastructures. The high acceptance by both academic and industrial researchers demonstrates the success of ESMI and the need for a distributed infrastructure to serve the European soft matter research community.

Joint Research Activities: Common efforts of the consortium partners were dedicated to develop new infrastructure and to improve the existing one in three categories.
New synthesis and purification routes were developed to broaden the range of available soft matter systems. Groundbreaking work led to the production of completely novel materials and in parallel the quality and availability of systems known beforehand were largely improved in terms of quantity and purity.
Research on the enhancement of inspection techniques resulted in novel instruments which allow the investigation of aspects of soft matter physics which were not accessible before. Advancement of sample environments for existing instruments improves their versatility by allowing for the inspection of samples with the same technique under a variety of different external conditions.
Theoretical and simulation research generated methods for the prediction of material properties which could not be captured previously, either by analytical theory or by computer simulations.

Networking activities: Through its networking activities, ESMI achieved the integration of the European key facilities for soft matter research. Dissemination of knowledge and the spreading of excellence were accomplished by organizing and supporting a variety of workshops and conferences, presenting events independent of ESMI and by publishing in scientific journals. By organizing and supporting themed workshops, schools and laboratory courses ESMI contributed to the continued education and training of soft matter researchers, thereby strengthening European competitiveness in soft matter research and soft nanotechnology. Particular effort was taken to maximize industry awareness, resulting in industrial participation in all ESMI activities at a level between 5 - 7%.

Context and objectives

Despite the fact that soft matter is ubiquitous in daily life and plays a fundamental role in biology, research on soft matter used to be fragmented into a variety of fields. These were separated along the lines of different materials such as polymers, colloids, surfactants, liquid crystals etc., and dispersed over various disciplines such as physics, chemistry, simulation sciences, chemical engineering and biology. In this unsatisfactory situation, the EU-funded Network of Excellence SoftComp was established by a number of leading soft matter groups in Europe with the aim to foster the integration of European soft matter science.

Based on the experience of the NoE SoftComp, the ESMI consortium set out to build a distributed infrastructure which would provide transnational access to all European soft matter scientists, offering them opportunities of synthetic, experimental and computational research far beyond their own laboratory capabilities. ESMI started up in January 2011 and was supported by the EU for five years. The transnational access (TNA) activities of the infrastructure was complemented by a wide-ranging networking programme for the integration of the soft matter community, the dissemination of knowledge, the education of young scientists and the training of TNA users. ESMI's activities were completed by an ambitious joint research programme dedicated to establishing new infrastructures and improving existing ones.

Transnational access activities:

The TNA activities were organized in three work packages: experimental, synthesis and computational infrastructures. The access to all these installations was offered through a peer-review system of submitted proposals which was operated online-only at the single entry point of the ESMI web portal.

WP3 ESMI Experimental infrastructure: The objective of this WP was providing access to the ESMI experimental infrastructure, which consists of state-of-the-art instruments available for cutting-edge soft matter research. The ESMI experimental infrastructure comprises light, neutron, synchrotron scattering instruments, rheometers, dielectric and NMR spectrometers, electron and optical microscopes, together with a variety of ancillary equipment and sample environments. The ESMI infrastructure is located in eight European laboratories.
The ESMI experimental infrastructure received 187 successful proposals to which 1900.33 days of access were allocated, which corresponds to 93 % usage of the planned capacity.
WP4 ESMI Synthesis infrastructure: The objectives of this WP were devoted to accessing the ESMI synthesis infrastructure, which consists of state-of-the-art synthesis capabilities comprising world leading polymer and nanoparticle synthesis laboratories located in three European countries.
The ESMI synthesis infrastructure received 31 successful proposals to which 789 days of access were allocated corresponding to 93 % usage of the planned capacity.

WP5 ESMI Supercomputing infrastructure: The objective of this WP was to provide access to the ESMI supercomputing infrastructure, which consists of the JUROPA machine, available at Forschungszentrum Jülich. This infrastructure provides a powerful tool for the prediction of soft matter properties using computer simulations.

The ESMI computation infrastructure received 20 successful proposals to which more than 129000 Tflophours of computing time were distributed, which corresponds to 88 % usage of the planned capacity.

Joint research activities:

The ESMI joint research activities, dedicated to improving existing infrastructure and developing new ones was organized in four work packages, i. e. new theoretical and computational tools, new experimental methods, new sample environments and novel synthesis routes.

WP6 Computational tools to support the design and interpretation of experiments on soft matter: The objective is to further develop and combine existing simulation techniques of flowing soft matter into hybrid methods, which are able to describe a wide range of soft matter systems, including those with internal hard or flexible interfaces. Rheological protocols to disentangle and identify different time scales will be tested and new ones will be devised. Analytical methods will be developed to describe heterogeneous flow properties in bulk, near walls and in microfluidic devices.
Progress towards the objectives was achieved by tackling the following specific tasks.

- Development of hybrid simulation techniques for soft matter systems with hard and flexible interfaces
- Creation of computational tools to support the interpretation of rheological experiments.
- Design of rheology measurement protocols for very slow systems

WP7 Novel experimental technique development: There are two emerging trends and areas of interest in soft matter research: the study of increasingly complex systems with structural and temporal responses over a wide range of scales and investigating their responses under the effect of various external fields. Therefore, the objective of this work package was to develop new experimental techniques that will allow in-depth characterization of a wide range of complex soft matter systems and their response to external fields and associated far-from-equilibrium phenomena. Industrial partners were involved in joint technique development to help ensure that new techniques are user-friendly and robust so that they can eventually be easily utilised by the wider soft-matter community.
In particular the following experimental methods and instruments were newly developed:

- Fourier transform dynamic Raman scattering
- Ultra-small-angle dynamic and static light scattering
- Optimized transmission electron microscopy for soft matter
- Nano dielectric spectroscopy
- Experimental set-ups for advanced interfacial rheology
- Real time analysis confocal microscopy data
- Laser tweezers set-ups for thick samples
- High frequency rheology

WP8 Development of sample environment: This work package aimed at building up novel sample environments on existing infrastructures. The topics have been chosen to allow for a wider range of users to successfully exploit the techniques already available and to develop user interfaces that enhance the capabilities of existing equipment in the consortium to address a wider range of scientific and technological challenges and to further stimulate user access in the future.

A range of sample environments was developed that open up the capabilities of the experimental platform to new types of samples or new types of problems to be studied, which are in detail:

- Universal magnetic field sample environment for time-resolved small-angle scattering experiments
- Sample cells enabling the study of wall and confinement effects on the rheology of colloidal dispersions
- User-friendly environments for dynamic light scattering on non-ergodic samples at rest and under shear
- Microfluidic sample environments for local scale microstructure measurements
- Thermal diffusion cell in combination with confocal microscopy

WP9 Synthesis of tailored systems: This work package aimed to strengthen the basis for new materials used in the soft matter field. The new synthesis methods developed in this work package shall be taken up in the TNA activities in order to facilitate the access to new soft matter samples. Specifically, the following three research areas were addressed:

- Development of surface modification methods for nanoparticles in order to make them compatible with matrices such as polymers.
- Synthesis of novel polymer bio hybrids by combining polypeptides and polycopeptides with synthetic polymers to combine the properties of peptides and synthetic polymers
- Production of polymers with special architectures such as ring or branched polymers in larger quantities and of a higher structural quality.

Networking activities:

ESMI networking activities were dedicated to the integration of the European key facilities for soft matter research, the dissemination of knowledge and spreading of excellence, providing continued education and training of soft matter researchers, and maximizing industrial participation in all ESMI activities. The work was organized in two work packages, for dissemination, education and training, and for industrial liaison, respectively.

WP1 Networking, Dissemination, Education and Communication: This WP had multiple objectives. First of all, it ensured the successful dissemination of ESMI-related information. Secondly, it provided a coherent programme for the continued education and research training of young and industrial researchers and facilities' users in the various areas of soft matter. Thirdly, an effective communication programme ensured Europe-wide awareness of the opportunities offered by the ESMI project.

In particular, ESMI

- co-financed and organized dissemination events, such as workshops and conferences on soft matter topics
- co-financed and organized schools and laboratory courses dedicated to training on soft matter subjects
- operated a web site and regularly issued newsletters and mailings to provide the soft matter community with updated information.

WP2 Liaison to industry and related initiatives: The objective of this WP was to develop a roadmap for establishing links to the industry by addressing technological needs and to enhance industrial involvement in ESMI activities.
To accomplish these tasks:

- an industrial user group was established to coordinate ESMI industry relations and to advertise ESMI to external companies
- a road show was produced, which ESMI leading scientists used to introduce the options ESMI was offering to industrial users

This resulted in an industrial participation in all ESMI activities of about 5%.

ESMI main research results.

ESMI research activities were organized in four work packages and resulted in a variety of improvements to existing facilities and the development of new methods and techniques. These are described in detail in the ESMI periodic reports. Here we will highlight the most important and prominent outcome of the ESMI JRA. Please note that in many cases this report is linked to graphs and images, which are not displayed in the online version. For a more comprehensive presentation the reader is referred to the attached PDF-version.

WP6 Computational tools to support the design and interpretation of experiments on soft matter:

Task 6.1: Development of hybrid simulation techniques for soft matter systems with hard and flexible interfaces:

- The properties of MPCD fluids were studied in detail and the influence of hydrodynamic correlations on the dynamics of polymers was fully elucidated. The RaPiD model was extended to better describe shear thinning and elongation rheology. The link between atomistic detail and RaPiD parameters was established. A hybrid model combining MPCD and RaPiD particles was established.
- We developed a method to perform MPCD simulations near complicated geometries which was validated by studying the sedimentation of red blood cells. A dissipative particle dynamics (DPD) simulation approach describing the appearance and growth of flexible interfaces by self-assembly in amphiphilic systems has been developed and successfully applied. We developed a model to simulate hard lath-like particles and studied their gel transition. Smoothed particle hydrodynamics (SPH), originally invented for astrophysical calculations, was adapted for use in complex liquids exhibiting shear-banding, in close proximity to walls.

Task 6.2: Computational tools to support the interpretation of rheological experiments Design of rheology measurement protocols for very slow systems

- The RaPiD algorithm was applied to simulate rheological properties. In particular we investigated core-shell particles under melt conditions and validated the simulation results against experimental data from a star polymer melt of moderate functionality and low

molecular weight. Experimental collaborators provided rheological data for comparison with start-up and cessation protocols

- We developed an analytical theory for shear gradient coupling instability in glassy systems. Using a combination of Brownian Dynamics simulations and computational fluid dynamics, we found that hard spheres band with one of the bands being jammed.

WP7 Novel experimental technique development:

Task 7.1: Fourier Transform Dynamic Raman Scattering

Dynamic light scattering (DLS) is a convenient and widely used technique for the investigation of particle diffusion and particle size characterization. An extension to Raman scattering that is able to distinguish chemically different species could open up a wide field of promising new applications. In mixtures, the diffusion coefficients for different components could be resolved without special labelling, and an analysis of cross correlation of different Raman lines would contain the information if different species diffuse together and are thus attached to the same particle. While a simple implementation where DLS is performed on a single Raman line is clearly out of reach due to the low Raman intensities, a Fourier transform approach (e.g. in Fourier transform infrared (FTIR) spectroscopy), based on the interferometer, results in a sufficiently high intensity at the detector since all Raman lines, as well as the Rayleigh scattering, contribute to the signal.

In this project we have developed a new Dynamic Light Scattering (DLS) instrument that detects and analyses chromatic scattered light using Fast Fourier Transform (FFT) techniques. The instrument permits the measurement of particle diffusion coefficients as a function of the wavelength of the incident light. If the wavelength of scattered light is correlated to the chemistry of the scatterer, one could distinguish the dynamics of chemically different particles. We have successfully tested our new method first using the Rayleigh component of the scattered light, which results in quantitative agreement with the results obtained using classical correlation techniques on a commercial DLS spectrometer. While the main objective of using Raman lines in order to extract diffusion coefficients of colloidal particles with chemical specificity could not be achieved due to fundamental limits in the nature of the Raman light, there remain other, highly interesting potential applications for such an instrument. It could, for example, be applied in investigations of the dynamics of photonic colloidal crystals, where the ability to resolve correlation functions for different colours of the scattered (diffracted) light would result in an extremely efficient way of measuring dynamics for different crystallite orientations and crystal structures.

Task 7.2: Ultra-small-angle dynamic and static light scattering

At the start of the project, small-angle light scattering was already widely implemented in a number of commercial instruments designed to characterize colloidal particles with sizes typically larger than 100 nm. However, these instruments allowed for static measurements only. This was quite in contrast to trends in soft matter research, where in particular in the investigation of complex fluids exhibiting slow dynamics, dynamical arrest, phase transitions of gel and glass transition access to

dynamic light scattering at low and ultra low angles becomes important. Several research groups had pioneered such studies, but no commercial instrument was available. Moreover, the software used to obtain, for example, correlation functions using multi-speckle correlation techniques was generally far from being user- friendly, which is an essential requirement for its use in a TNA programme or for successful commercialization. We therefore planned to develop a CCD camera-based light scattering set-up for static and dynamic experiments at low and ultra-low angles, combined with user-friendly software.

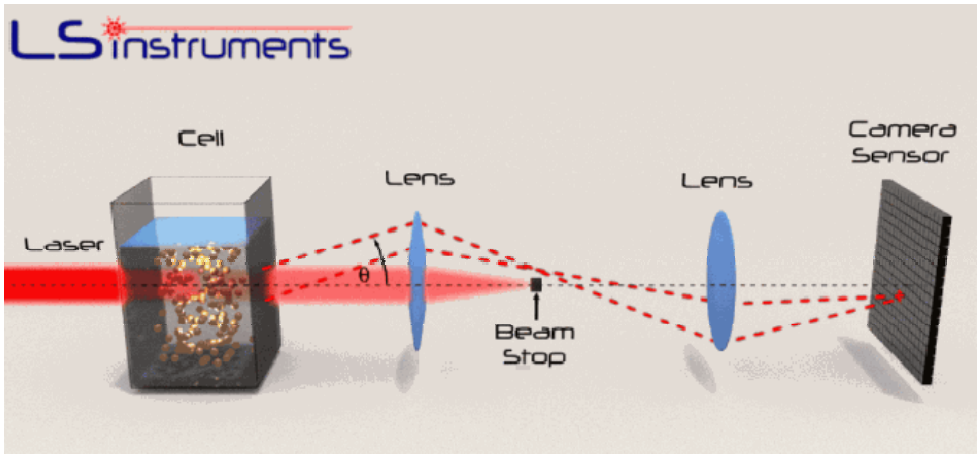

Figure 7.2.a Sketch of the U-SALS set-up.

A new SALS design was developed, which is sketched in Figure 7.2.a. The set-up is optimized for use with the latest generation of optical and electro-optical components (cameras, lasers, optical elements). Care was also taken to allow the integration of anticipated developments in the future. The software structure and layout was concluded. Functionality requirements for a commercial product were identified. Programming of drivers for key components and communication interfaces were concluded. A first prototype was assembled and feasibility tests conducted. A webpage was established at

http://www.lsinstruments.ch/technology/small_angle_light_scattering

to introduce and explain SALS and USALS to scientist unaware of the technology.

Task 7.3: Optimization of Electron Microscopy for Soft Matter

Since the start of the project, significant progress has been made concerning the optimization of soft matter imaging using transmission electron microscopy. The most important steps in the optimization correspond to the reduction of beam damage during sample preparation as well as during imaging in the microscope. Further, special attention was paid to the 3D investigation of soft matter and self assembly by electron tomography.

a) Minimization of beam damage:

In order to reduce the effects of beam damage during characterization by electron microscopy, we evaluated the use of so-called “high angle annular dark field scanning transmission electron microscopy” (HAADF-STEM), an advanced electron microscopy technique. HAADF-STEM is commonly used in the field of "hard matter", but its application for soft matter materials is currently limited. HAADF-STEM uses a focused beam rather than a parallel beam and scans across an area of interest. Even though a relatively high current is used, the technique can be considered as a low-dose imaging technique because of the extremely small dwell times that are used at each scanning position. We have successfully used HAADF-STEM in the study of insulin fibrils, colloidal nanoparticles, porous materials and polymer systems.

Another approach we investigated to minimize the effect of beam damage is the use of low acceleration voltages. Working at acceleration voltages as low as 80kV reduces knock-on damage caused by the electron beam, but will also reduce the spatial resolution. We have demonstrated that the use of aberration-corrected transmission electron microscopy yields images that still show atomic resolution, even at 80kV. As an example, we successfully imaged glycogen-based nanoprobes that were investigated in collaboration with Dr. Sergey Fillipov (Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic) in the framework of a transnational ESMI project. From this and other studies, it could be concluded that the current of the electron beam is the most crucial factor and should be lower than 40pA. We consider this as the tolerance level for these materials.

Although use of low acceleration voltages in TEM (80 kV, 60 kV or even lower) limits knock-on damage to sensitive materials, ionization damage, caused by local heating of the sample, is increased in low-voltage TEM. To counteract this local sample heating, recent experiments on sensitive metal-organic framework samples (MOFs) were carried out at 80 kV acceleration voltage, under cryo-conditions. This approach greatly increases the framework stability. Using these cold imaging conditions, we were able to image the in-tact pore structure of delicate MOF-5 crystals for the first time in a TEM.

b) Optimization of sample preparation:

Soft matter samples such as polymer systems are often prepared for TEM investigation using an ultra microtome. However, cutting artefacts can be present when using this technique. In addition, the samples are often still too thick to enable the use of advanced TEM techniques. Furthermore, ion beam milling has been tested in the study of carbon-based materials as well as anodized aluminium oxide membranes. Although these trial studies resulted in useful TEM samples, their preparation must be carried out with great care and is very time-consuming. Another disadvantage is the fact that both the ultra microtome and the ion mill are not site-specific. The use of focused ion beam milling (FIB) has as a major advantage that it is indeed site specific. Until recently, FIB was only used for hard matter compounds. The FIB installed at the University of Antwerp can be used at flexible acceleration voltages as well as a broad range of ion beam currents. In this manner, a protocol has been developed in which the initial rough milling is carried out at high voltages and at high currents. This initial approach is followed by sequential steps at lower voltages and currents.

The final milling steps, resulting in lamellae with a thickness of approximately of 80 nm or less are carried out at an acceleration voltage as low as 1kV and a beam current of 75 pA. Using this approach, a broad range of samples has been prepared with great success including polymers, porous membranes and biological cell tissue. Also needle-shaped samples for electron tomography can nowadays be prepared successfully.

For cryo-microscopy, we have implemented the use of a plunge freezing device (Vitrobot Mark IV). This technique can be used to form a thin layer of amorphous ice in which the sample is embedded. We came to the conclusion that it is of great importance to first make the TEM grids hydrophilic using a plasma. Using this approach we can study samples in their native conditions (e.g. during an ESMI TNA project concerning assemblies of nano-dumb-bells) Furthermore, cryo-microscopy can greatly reduce electron beam damage as explained above.

c) Evaluation of the Recording Medium:

The use of HAADF-STEM enables imaging of soft matter with sufficient contrast using the newest generation of HAADF detectors. By optimizing the collection angle of the detector, the contrast can be optimized for each specific sample. We also demonstrated that the use of ADF-TEM is very useful in this respect. A major advantage of the ADF-TEM technique is the absence of scanning noise and, perhaps more importantly, the easy insertion of an ADF-TEM aperture in a TEM configuration using a CCD camera, whereas ADF-STEM requires a dedicated system that includes an annular dark field detector. These findings might favour the use of ADF-TEM to image soft materials.

Recently, we have tested the use of a so-called Super-X system, which consists of 4 windowless energy-dispersive X-ray spectroscopy (EDX) detectors symmetrically arranged between the pole pieces of the objective lens at a short distance from the sample. As a consequence, a high X-ray count rate is obtained and the detection efficiency for light elements is increased with a factor of 20-50. The successful use of this detector was demonstrated during an ESMI TNA project

d) Optimization of Statistical Treatment and Software:

An efficient way to interpret images with low signal-to-noise ratio in a quantitative way is by using statistical parameter estimation theory. In this theory, use is made of a model which is parametric in a set of unknown structure parameters, including, for example, the object size, orientation, shape, and location. These parameters can then be measured by fitting this model to an experimental image. Therefore, a criterion of best fit is employed, which quantifies the similarity between the images and the model. This methodology makes optimal use of the available measurements, which is of critical importance since electron microscopy experiments are more and more limited by the maximal allowable dose. In order to further improve its performance, a new method was developed to explore the optimal experimental settings to detect light atoms from scanning transmission electron microscopy (STEM) images. Since light elements are important in soft matter, great efforts were made to optimize the STEM technique in order to detect these elements. Therefore, classical performance criteria, such as contrast or signal-to-noise ratio (SNR)

are often discussed here in order to improve the direct visual interpretability. However, when images are interpreted quantitatively, one needs an alternative criterion, which we derive based on statistical detection theory. Using realistic simulations, we demonstrate the benefits of the proposed method and compare the results with existing approaches.

e) 3D investigation of self-assembly by electron tomography

For the characterization of nano-assemblies, electron tomography is nowadays a standard technique, yielding a 3D description of the morphology and inner structure. However, 3D reconstructions based on classical algorithms, suffer from a number of restrictions. Most importantly, for soft samples degradation due to the electron dose often occurs. As a consequence, the projections were mostly acquired with tilt increments of 1°-5°, yielding an under-sampling of the higher frequencies and a consequent degradation of the resolution with a blurring of the sharper features. We therefore developed a novel approach at the University of Antwerp that enables us to determine the coordinates of each nanoparticle in an assembly, even when the assembly consists of up to 10,000 (spherical) particles. This technique has a major impact as it enables a straightforward quantification of inter-particle distances and 3D symmetry of the stacking. Furthermore, the outcome of these measurements can be used as an input for modelling studies that predict the final 3D structure as a function of the parameters used during the synthesis.

Task 7.4: Nano Dielectric Spectroscopy

A new experimental approach for the characterization of molecular dynamics at the nanoscale by broad band dielectric spectroscopy has been implemented on a commercial AFM. We have developed the experimental protocol and a user friendly interface for nano-dielectric spectroscopy experiments using LabView (see Figure 7.4.a). In this way this innovative approach has become available to non-expert external users in the ESMI TNA programme. Furthermore, a detailed numerical model and a semi-quantitative analytical equation connecting the measured signal and the complex local permittivity have been established.

Finally, we have explored the suitability of this experimental method in various soft matter research lines.

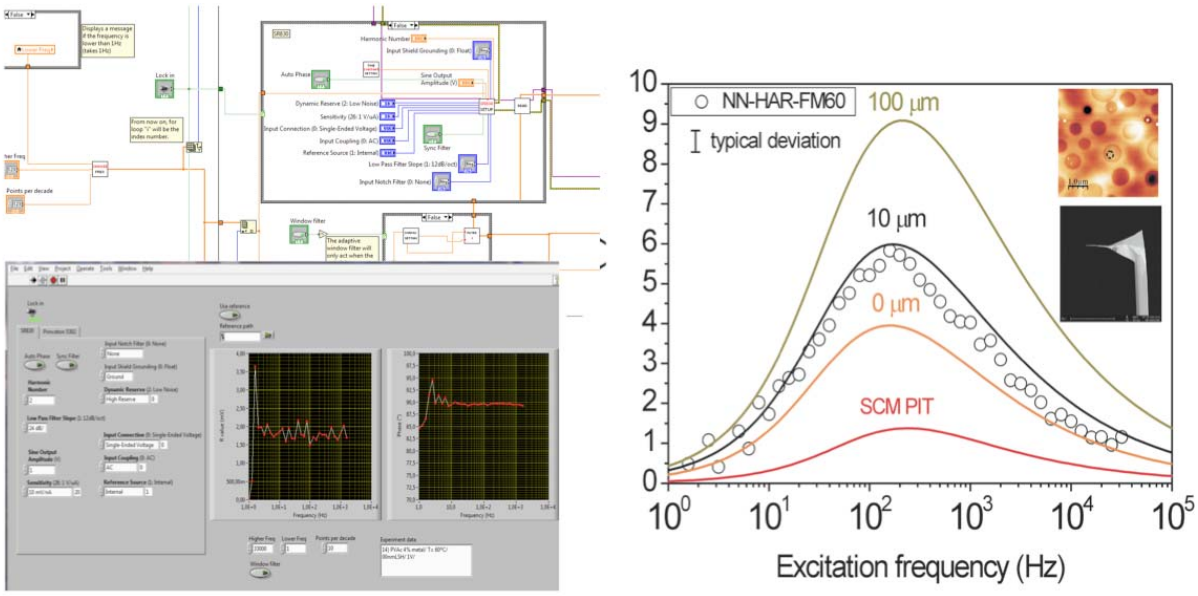

Figure 7.4.a. Front panel of the user interface and part of the program developed in LabView. Right panel shows an example of the measured and modelled signals.

Task 7.5: Experimental Setups for Advanced Interfacial Rheology

A quantitative description of the material properties and the rheological material functions of highly elastic interface layers represent the basis to understand not only the functioning of biological systems (such as breathing mechanism of lung alveoli), but also to optimize and improve industrial processes that involve multiphase systems like foam and emulsions.

It has been proved in the past that the use of a rectangular Langmuir trough especially for highly elastic systems introduces a complex 2D state of stress; in fact in this kind of geometry the interfacial stress is determined by both dilatation and shear response of the interface. In order to obtain a proper quantitative characterization of the response of these systems to a uniform dilatational deformation where no shear contributions are induced, an advanced version of radial trough apparatus has been designed, which is shown in Figure 7.5.a.

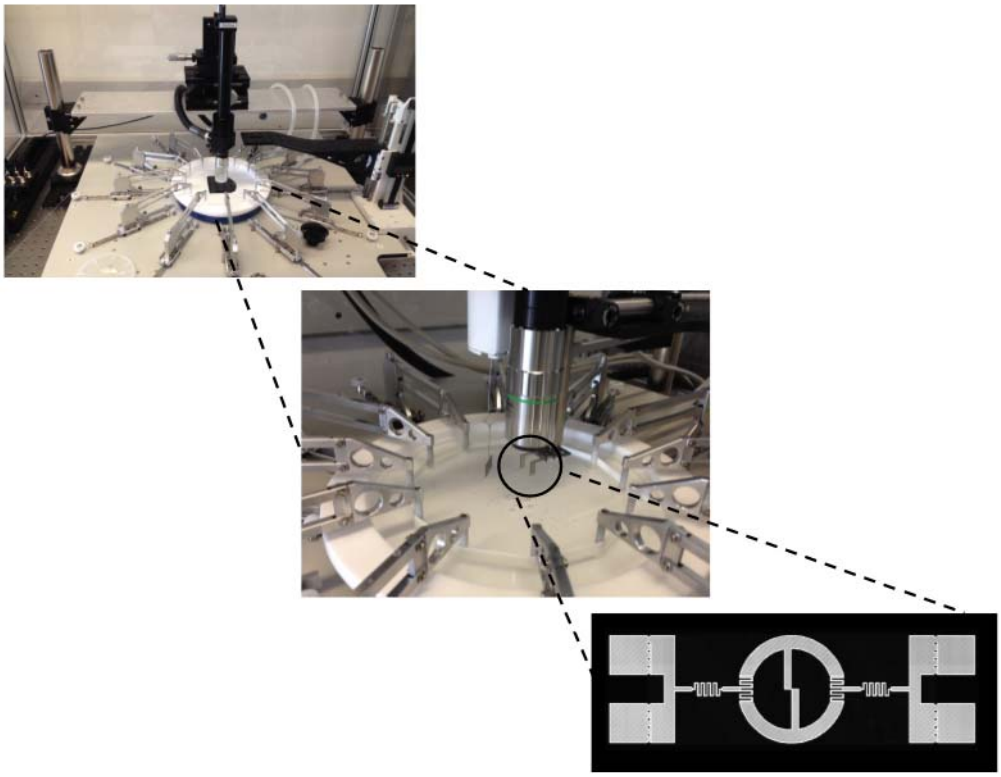

Figure 7.5.a Radial trough apparatus equipped with an optical train system to visualize the microtensiometer for surface pressure measurements.

Thanks to a precise driving mechanism, twelve aluminium fingers pull simultaneously on an elastic band in a coordinated way, creating approximately a circular shape. Each finger is placed on a slide rail and connected to a linear stage motor by an ultra high molecular weight polyethylene wire. An accurate calibration procedure previous to each experiment ensures a precise and reproducible initial position of the elastic band. Additionally, this apparatus is equipped with an advanced optical system that allows visualization of the interface to characterize the applied dilatational flow field and perform particle tracking. A wide range of interfaces can be studied, including recently characterized polymer multilayer systems directly assembled in situ using a sub-phase exchange system.

The material properties that can be determined with the radial trough apparatus are surface pressure-area isotherms and pure dilatational rheological parameters. Standard for a radial geometry, surface pressure is measured using a platinum rod connected to a Wilhelmy balance. Although this technique respects the radial symmetry, this widely used technique has numerous disadvantages: evaporation and buoyancy effects, distortion of the interfacial stress profile around the probe and limited frequency range of oscillatory rheological measurements. With the goal of overcoming these restraints and at the same time increasing the sensitivity, a miniaturized set-up for tensiometry measurements has been developed and tested, based on an idea by Zell et al (Z.A. Zell et al., Appl. Phys. Lett. 97 (2010) 133505). This set-up consists of a microtensiometer made out

of a semi-flexible polymer structure placed at the interface. The gradient in surface pressure between the in- and outside of the tensiometer will cause the device to be compressed through flexible millimetre-scale springs. Using the previously mentioned optical set-up, the deflection and hence the related surface pressure can be determined.

Proof-of-principle oscillatory measurements showed a remarkable agreement between the values of surface pressure independently detected by the Wilhelmy balance and by tensiometer deflection. Furthermore, the instantaneous response of the tensiometer set-up allows for high frequency measurements, up to frequencies in a range much higher than currently reported in the literature. The whole system is now operational, validated and ready for use in TNA experiments.

Task 7.6: Advanced Confocal Microscopy

State-of-the-art confocal microscopy systems enable users to acquire high quality images at very high speeds generating vast amounts of data. However, the only instantaneous information available to the experimentalist is (some of) the raw image data, which often is not enough to ascertain that experimental parameters have been optimised and may considerably limit the efficiency of experiments. Therefore, the usability of the existing rheo-imaging set-up at the University of Edinburgh, which relies on a fast confocal microscope, was drastically increased by implementing real-time image analysis.

Real-time availability of image data is achieved by streaming individual image frames (together with some of the relevant meta-data) to a SSD RAID array as soon as they are captured (Figure 7.6.a).

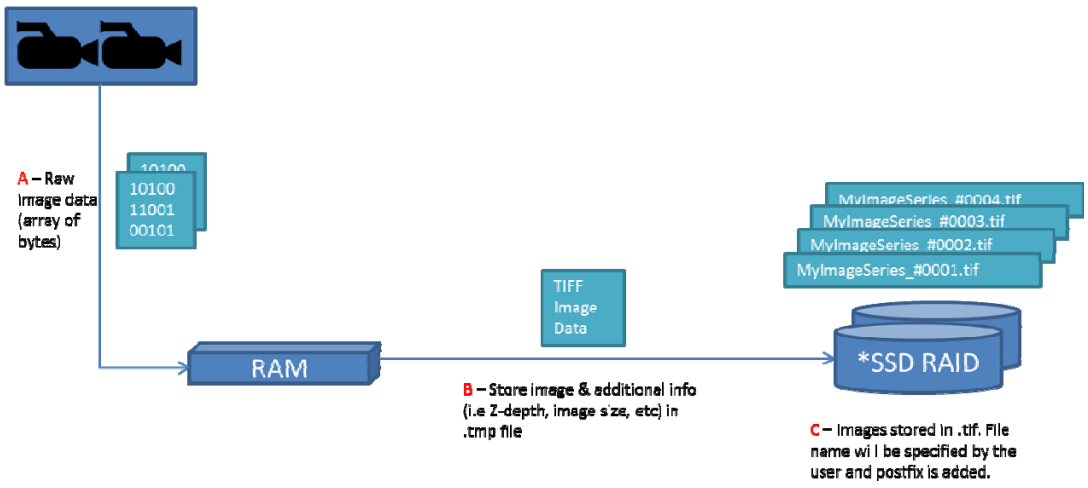

Figure 7.6.a: Image capture providing temporary images in real time.

A user-friendly software package was devised that analyses these temporary image files 'on the fly' and also optimizes the hardware design in order to deliver a 'confocal microscopy based flow

visualization device'. This integrated system was tested and fully commissioned for access by external users.

The rheo-imaging set-up consists of a commercial rheometer (Physica MCR 301, Anton Paar) which is mounted on top of a confocal research microscope (Nikon TE300 with the upgraded VT-Eye confocal). The microstructure of the sheared sample can be imaged through the custom glass bottom plate of the sample stage. One of the basic analysis steps consists of checking the flow profile of the sample, as this can easily identify experimental artefacts such as wall slip.

To perform this analysis 'on the fly', the software package needs to

1. Monitor the directory receiving the temporary image files for the arrival of new image files (once the acquisition has started)
2. For each new file read the image data and extract its time stamp and position data
3. Process this new data to quantify the flow in the system
4. Present the results to the user as they become available

The software package was implemented in MATLAB, which provides acceptable performance with a fairly straightforward programming environment. The core analysis step consists of calculating the Pearson correlation of two successive images at the same z position (height) within the sample. The shift leading to the highest correlation is then estimated with sub-pixel resolution. From this the average shear rate at a given height can be determined and by analysing a confocal stack, the complete shear profile of the imaged sample volume is calculated.

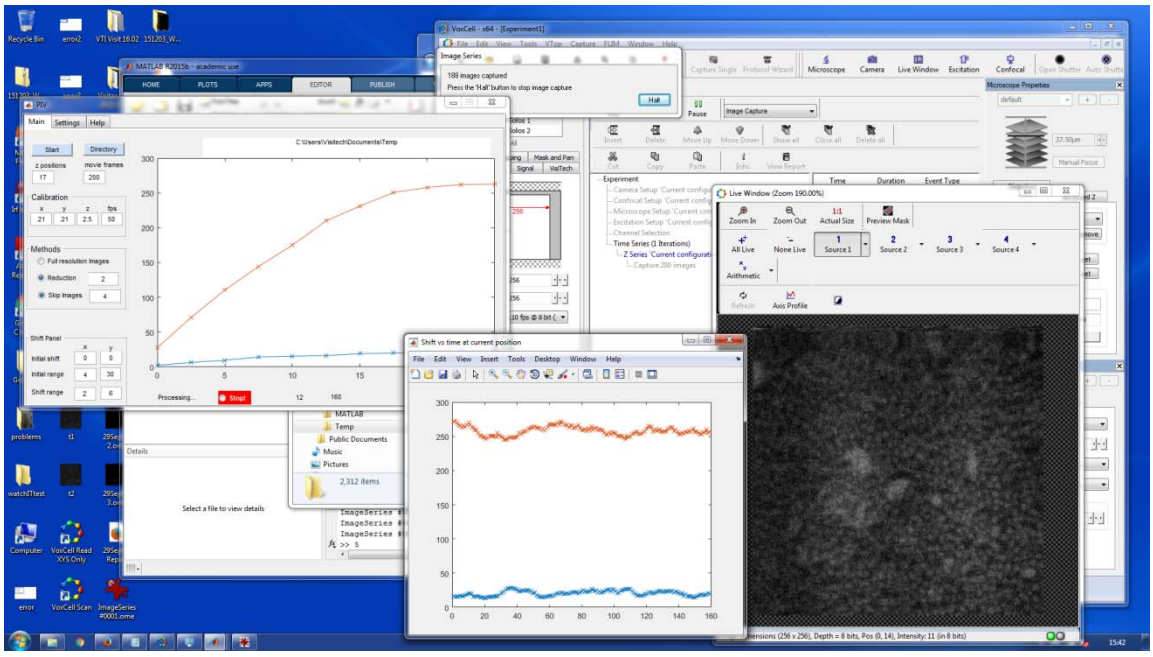

Figure 7.6.b: Screen shot of real-time analysis being performed during the acquisition of a z-stack of movies of a sheared sample.

For relatively small image sizes and slow frame rates (256x256 pixels, 15 fps) the full analysis can be performed in real time. For larger images sizes and/or faster frame rates the GUI includes options

to reduce the image size by binning or the frame rate by the skipping of frames, and can thus still allow real-time feedback. The analysis results are also saved to disk to facilitate more detailed off-line analysis.

Although the software is primarily designed for “on the fly” processing of image data generated by the VT-Eye confocal system, it can also be used to analyse pre-recorded data, such as the OME-Tiff stacks saved by the Visitech confocal software or avi files recorded by our camera-based epi-fluorescence rheo-imaging set-up.

The software development was complemented by improvements to the overall design of the system, for example by inclusion of a temperature control for our custom rheo-imaging base plate. The system is now operational, and was used in TNA experiments.

Task 7.7: Advanced laser tweezers set-ups for thick samples

Optical tweezers are a very versatile tool for studying soft matter, with applications ranging from simple manipulation of microscopic particles to highly quantitative measurements such as characterization of the interaction potentials between colloids and micro-rheology measurements. However, most implementations used for quantitative measurements require good optical access to the sample from both sides, severely restricting the types of samples that can be used. We added a new measurement modality to the existing dual-trap optical tweezers (OT) set-up, where the positions of the trapped particles are monitored with a high performance digital camera. The images are analysed to track the particle positions and deduce interaction potentials and rheological data.

a) Quantitative force measurements

‘Traditional’ set-ups for force measurements need good optical access to the sample from both bottom and top. In this implementation, determining the deflection of the transmitted light of the laser beams used to trap them monitors the positions of two trapped particles. As this implementation uses simple semiconductor detectors (quadrant photo diodes) relatively high sampling rates (10s of kHz) can be achieved routinely and it is straightforward to convert the voltage signals from the detectors into position information with resolution better than 10nm.

However, often such high bandwidth is not required, making it feasible to implement quantitative force measurement set-ups using fast cameras. In this case, good optical access to the sample is only required from one side, allowing for measurements in thick samples

We successfully tested several locally available cameras camera (Pulnix TM6740, Mikrotron MC1362 and Orca Flash 4.0) for recording movies of trapped particles. The Pulnix camera was sufficiently fast for most applications and was therefore chosen for the default configuration. We wrote custom software code in Labview (as well as Matlab) to track the particle positions with sub-pixel accuracy and extract the viscoelastic properties of the suspending medium. A second modality

that we implemented is the use of two alternating traps to perform wideband microrheology to measure the viscoelastic properties of complex fluids. In this scenario, two nearby traps are modulated in an alternating fashion, forcing a single probe particle to move between the two trap positions.

b) Combining confocal imaging with optical tweezers

Confocal microscopy and optical tweezers can in principle be combined using the same objective for both systems. However, in this configuration neither system is independent. For instance, it would be impossible to hold a particle in an optical trap and simultaneously scan the regions above and below this particle without moving the particle in the process. This obstacle can be overcome by using independent objective lenses either side of the sample. This enables the operation of both systems to be entirely independent, but requires good optical access from both sides of the sample, thereby preventing experiments on very thick samples.

In our implementation we combine confocal microscopy and optical tweezers through the same objective but use a remote focusing technique to make them independent. Remote focusing is a relatively new technique which allows focusing to be carried out externally without introducing severe optical aberrations. It does not require the main objective (or sample) to move in order to acquire a confocal stack. The axial position of the optical tweezers trap within the sample can thus be controlled independently, namely by adjusting the separation of sample and main objective.

We have combined a user friendly optical tweezers system with a commercial confocal microscope (Biorad Radiance 2000MP attached to a Nikon TE-2000 inverted microscope). We used a dual-objective focusing rig to improve the optical efficiency. We engineered a coupling of the confocal microscope to the tweezers set-up that is stable enough for routine use and enclosed the optical path in critical locations for user safety. The set-up is operational, as shown by the z-stack displayed in Figure 7.7.a and was fully commissioned for user access by July 2015.

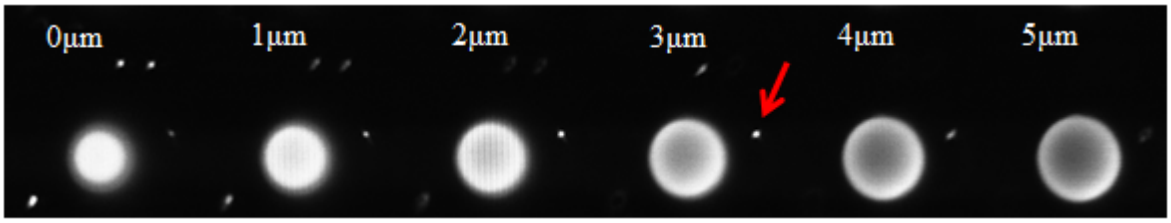

Figure 7.7a: A 1µm bead is trapped and positioned 3µm above the cover slip and to the right of the larger 15µm diameter bead (highlighted by the red arrow). Other1µm beads are stuck to the cover slip or are freely diffusing through the sample. The separations indicated are the distance between the cover slip and the focal plane. The confocal image stack can be acquired without disturbing the trapped particle.

Task 7.8: High Frequency Rheology

High-frequency rheology provides insight into the microstructure, interactions and local dynamics of complex fluids. Conventional rheometers are limited in frequency to about 10 Hz due to inertial contributions. Since time-temperature superposition is not suitable for many complex fluids, a homebuilt rheometer was developed to enable rheological measurements at higher frequencies. We have shown how resonator devices could achieve high sensitivity, but their functioning is limited to rather low viscosity materials. Therefore we investigated whether another technology could be of use and developed a piezo shear high frequency device, capable of measuring materials with higher viscosities/moduli.

The rheometer (Figure 7.8.a) makes use of two stacks of piezo-elements, operated in shear mode and mirrored against each other, with one element acting as attenuator and the other as detector. This results in a pure shear motion with a continuous frequency range from 10 − 3000 Hz, up to the first resonance frequency. At an operating gap of 100 µm, 10 µL of sample volume is required. A high-performance lock-in amplifier is used both for generating a sinusoidal shear motion and detecting the output signal. Alignment is carried out by a combination of piezo-screws and inductive proximity sensors, offering a sensitivity < 100 nm. In Figure 7.8.b the raw value of the complex modulus G* of PDMS (5000 cSt), measured by the novel high-frequency rheometer, is shown. The un-calibrated data agrees reasonably well with moduli obtained with a commercial stress-controlled rheometer (TA Instruments, Discovery Hybrid Rheometer 3) and an earlier developed piezo-rheometer (Roth et al., 2010).

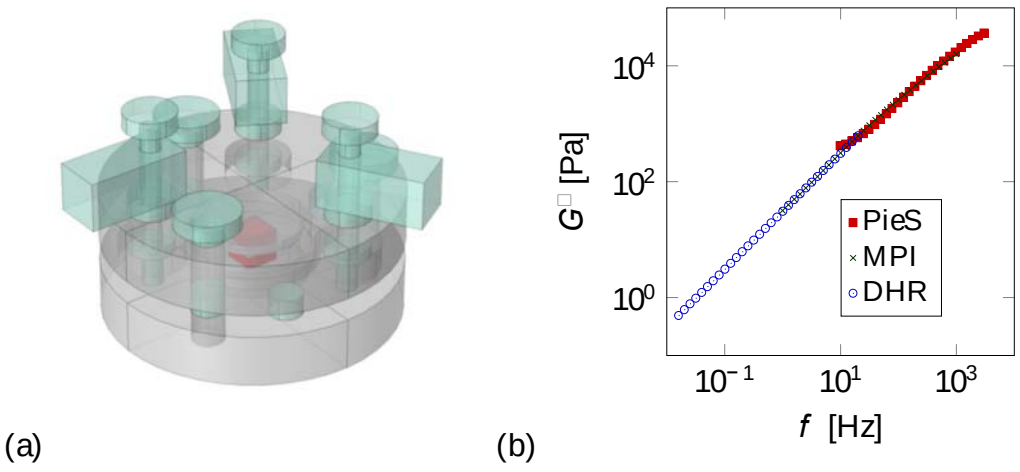

Figure 7.8 (a) High-Frequency Rheometer. (b) Complex modulus of PDMS (5000 cSt) as a function of frequency, measured with different rheometers (DHR: commercial rheometer, PieS: current device MPI: data from M. Roth et al J. Chem. Phys. 132, 124702 (2010).

WP8 Development of sample environment

Task 8.1 Universal magnetic field sample environment for time-resolved small-angle scattering experiments

This task concerns the development of a flexible sample environment for measurements in both static and dynamic magnetic fields where the local magnetic field can be correlated with the results from different small-angle scattering techniques to investigate time-dependent structural properties such as local viscoelastic properties in complex soft matter

We have constructed a final version of a Helmholtz coil sample environment, which allows for time-resolved small-angle scattering measurements, for the investigation of field-induced structures and anisotropic diffusion as well as for field-driven rotational motion of anisotropic magnetic particles. The strength, direction and rotation frequency can be selected remotely, and when using it in combination with light scattering, the resulting field-induced structures can then be recorded in a time-resolved fashion either using transmission measurements with crossed polarizers, or using a fast CCD camera as a two-dimensional detector for small-angle static and dynamic light scattering. The coil set-up is designed for working with a variable sample holder that can use commercial Hellma quartz cells with different thicknesses, and is thus also suitable for SANS experiments. We have also adapted the coil system such that it can be used together with one of the light scattering goniometer systems available at the University of Lund in order to perform dynamic light scattering of anisotropic diffusion of magnetic particles in external fields

Task 8.2: Sample cells enabling the study of wall and confinement effects on the rheology of colloidal dispersions

In this task, sample cells for probing the phenomena occurring near walls are developed using two approaches. On the one hand, techniques which are sensitive to the structure and dynamics near walls such as total internal fluorescence microscopy and evanescent wave dynamic light scattering will be adapted and equipped with sample environments in which viscometric flows can be applied. On the other hand, a home-built high resolution fluorescence microscope will be incorporated in a commercial rheometer. To study the effect of confinement, a transparent plate-plate shear cell with distance tuneable on a micron scale and combined with microscopy techniques will be built.

a) Wall slip measurements with flexure-based rheometer

A flexure-based rheometer (FMR) at KU-Leuven as the reference tool for slip measurements has further been improved with a redesigned nanopositioning system to minimize compliance in the system and to enable shearing surface parallelism < 1 µrad. This had proven to be necessary in order to accommodate for the expected shear stress range of the fluids to be tested during the validation measurements of the set-ups developed at FORTH and FJZ. Furthermore, to study the effects of surface roughness under confinement and to control slip of the confined particle suspension shearing surfaces were developed with defined roughnesses of 0.1, 15 and 50 um while

maintaining the required flatness of the shearing surfaces of lambda/10 in order to set apparent gaps smaller than the actual surface roughness.

The improvements of the set-up have been validated with a model system of soft deformable particles in the form of the cross-linked poly(acrylamide) microgel particle system Carbopol. Initial investigations determined the true particle shape and dimensions in a swollen state using confocal microscopy on stained gel particles, in order to assess in situ the critical overlap concentration at which the swollen gel particles become space filling (Fig. 3a)

b) Near-wall dynamics under shear

At Forschungszentrum Jülich, a sample cell for near-wall velocimetry was constructed based on a plate-plate geometry applying an air bearing rotation device, used to rotate the bottom. The top plate, which is fixed, carries a semi-spherical lens, allowing for the creation of an evanescent wave and the measurement of correlation functions of the scattered intensity. Due to the symmetry of the above-mentioned lens, it is possible to change scattering vector components parallel and normal to the reflecting interface, independently of each other. It is therefore possible to study the particles's near-wall dynamics normal and parallel to the wall, which however comes at the cost of the top part having to be fixed and consequently the rheological response of the sample cannot be measured online.

c) Combination of rheology and evanescent wave DLS

A near-field velocimetry based on EWDLS set-up was implemented on a stress controlled rheometer (Rheometrics DSR) in FORTH. This model was chosen as it is specially adapted to rheo-optical measurements, having a very accessible and changeable bottom plate. Particular attention was given to the design of a special mount that allows the attachment of a semi-cylindrical lens together with a glass plate on the rheometer, where the glass serves as the bottom plate of the rheometric shear cell.

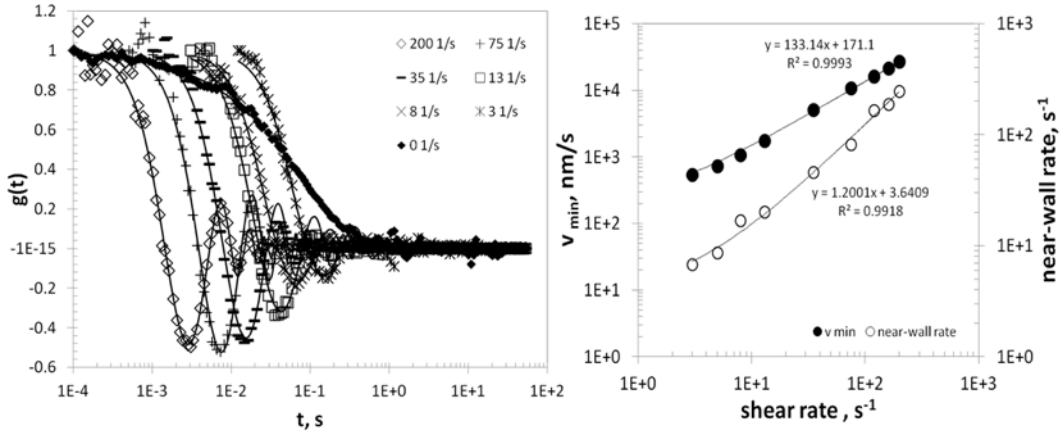

Figure 8.2.a: Left: Experimental surface correlation functions and best fits obtained with an appropriate theoretical expression. Right: Extracted near-wall shear rate and near-wall velocity as a function of the macroscopic shear rate imposed by the rheometer.

In the measured correlation functions, an oscillating signal is visible which can be attributed to the motion of tracer particles within the evanescent wave. From this signal, the near wall particle velocities and the local shear rate can be determined. Results from a feasibility test on a Silica sample in a water glycerol mixture are shown in Figure 8.2.a.

Task 8.3 User-friendly environments for dynamic light scattering on non-ergodic samples at rest and under shear

The aim of this task was to develop user-friendly software to open access to the so-called multi-speckle dynamic light scattering technique, where a 2D CCD camera enables averaging over a large number of independent speckles and thus the determination of the ensemble averaged correlation function representative of the dynamics of the sample. Multi-speckle set-ups for both single and multiple scattering samples in a well-thermostated environment shall be adapted for use on a commercial rheometer to enable simultaneous high quality DLS/DWS and rheological measurements for samples under steady and oscillatory shear.

The work towards building user-friendly MSDLS software has been undertaken along two lines. We have upgraded the software to allow for fast and reliable acquisition of multi-speckle DLS or DWS data both at rest and under shear. Secondly we have implemented image analysis within a commercial software (Igor +) that enables fast and automated fitting of the MSDLS time correlation functions as a function of waiting times. This part of the software, including acquisition and storage of data, analysis of data and calculation of the time correlation function and automatic plot of correlation functions, mean relaxation times and stretching exponents as a function of waiting times, is available for TNA users. The second and more ambitious step towards new software for calculating correlation functions in a much less time-consuming manner (or even possibly in real time) with the use of graphical processing units is still under way.

Extensive testing of the LS-echo and multi-speckle DLS (MSDLS) and rheometer combination built on an Anton-Paar MCR 501 stress-controlled rheometer and an ARES/TA strain- controlled rheometer demonstrated the feasibility of the technique. We have thoroughly discussed the technique and its capabilities with the industrial ESMI partner Malvern and investigated the option of the joint commercialization of the set-up. We have agreed on a project plan whereby FORTH will build a laboratory prototype of the set-up on a Malvern rheometer.

Task 8.4 Microfluidic sample environments for local scale microstructure measurements

Microfluidics offers unique opportunities to study the structure, dynamics, and kinetics of liquids, suspensions, and colloids. In particular when studying the response to concentration, solvent, or time lag, it is mandatory that all corroborative measurements be taken from the same sample volume at the same time. Microfluidic approaches have shown to be very powerful and promising

in this respect. A microfluidic system will be developed, which allows the remote-controlled flow and mixture of liquids in a sample container for concurrent small-angle X-ray scattering and UV-VIS spectroscopy.

A prototype device was developed at PSI which is suitable for X-ray scattering experiments in the momentum transfer range between 0.02/nm and 20/nm and which allows UV/Vis spectra to be acquired close to the position at which X-ray measurements take place. Consistent with design parameters, overall sample consumption for such a combined measurement was determined to be in the order of 30µl. Beyond the original specifications of the device, the importance of accurate temperature control was recognized. Consequently, temperature control was added to the device's capabilities.

Whereas basic functionality could be demonstrated, the prototype requires further modification to be suitable for standard TNA user operation. In its current form, the design requires too much device-specific expertise to be used by non-experts and has not been deemed fully suitable for regular user operation at the cSAXS beamline. However, parts of the device are used regularly for offline measurements, complementary to X-ray spectroscopy experiments at the PHOENIX beamline at SLS, e.g., surveying CaCO3 nanoparticle precipitation. Thus expertise gained, for instance, in regard to more user-friendly connectivity and window sealing, can be incorporated at a later point in a second version, which should be more amenable to use at the cSAXS and PHOENIX beamlines as originally envisioned.

Various microfluidic devices were developed for use with confocal microscopy, of which one proved particularly useful. This can be used in confocal microscopy and at the same time it is possible to use it for thermal diffusion measurements. The details of these results will be discussed in Task 8.5.

Task 8.5: Thermal diffusion cell in combination with confocal microscopy

Temperature-gradient induced mass transport in complex soft matter systems is a still largely unexplored. Therefore this task was dedicated to develop a thermal-gradient cell that can be used in combination with a confocal microscope. The combination of a thermal cell and microscopy is very useful for soft matter systems, since the diffusing entities are in the micrometer range. The use of existing set-ups is often complicated either due to strong scattering or due to rather long equilibration times in the order of days. The challenge here is to build a very thin cell (20-50 micron) in order to limit equilibration times and to apply an accurately controllable temperature gradient (temperature differences of the order 0.001 K).

Various dimensions and production methods were tested to manufacture microfluidic cells. The general design concept of the cell, which eventually proved useful, is sketched in Figure 8.5.a

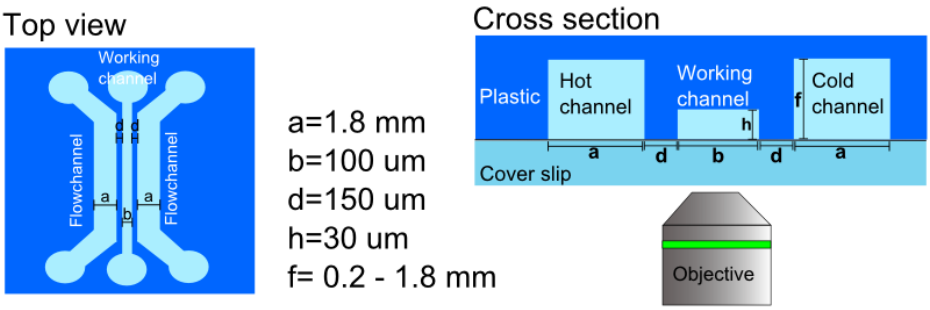

Figure 8.5.a: Schematics of the microfluidic cell. The central channel contains the sample to be investigated. The side channels provide the flow of hot and cold water and create the temperature gradient across the central channel.

For the quantitative description of the temperature gradient in the working channel, a calibration method based on fluorescence lifetime microscopy (FLIM) was developed. Using this cell in a confocal microscope it is now possible to measure the thermal diffusion properties of micron-sized colloidal objects.

WP9 Synthesis of tailored systems

Task 9.1: Surface modification and compatibilization

Various types of nanocrystals as well as combinations of these were capped with aminofunctionalized poly(isoprene)-diethylenetriamine. While the diethylenetriamine binds to the nanocrystal surface, the hydrophobic poly(isoprene) block is especially suited to be integrated in other hydrophobic polymers or block copolymers. The capped nanocrystals were then integrated in functional polymers and block copolymers via a micelle approach and seeded emulsion polymerization. As a demonstration system, an encapsulation in poly(isoprene)-block-poly(ethylene glycol) diblock copolymer (PI-b-PEG) was employed, which results in excellent water solubility and bioinertness of the nanocrystals. The encapsulation was performed via self-assembly processes of the amphiphilic diblock copolymers in water leading to micelle structures, in which the PI moiety is subsequently cross-linked by a radical polymerization using azobisisobutyronitrile (AIBN) as the initiator. Additionally, seeded emulsion polymerization with styrene/divinylbenzene can be used to further increase the stability and provide new functionalities. The system is extremely versatile. Instead of QDs, superparamagnetic iron oxide nanocrystals (SPIOs) and gold nanocrystals (Au), as well as arbitrary combinations of these, can be encapsulated. Moreover the PI-b-PEG can be functionalized and functional derivatives of styrene/divinylbenzene may be used in the seeded emulsion polymerization. This allows for the modification of the properties of the resulting composite, including polarity, solubility, zeta potential and stability under diverse conditions. Finally, the nanocrystals were incorporated in poly(isoprene). SPIOs (diameter 12 nm) were dissolved in a solution of poly(isoprene) in toluene. After removal of the solvent, a homogenous nanocomposite was obtained.

Task 9.2: New polymer-bio hybrids

The synthesis of new hybrid miktoarm star materials of the type (PBd)2PBLG, where PBd is polybutadiene and PBLG is poly(γ-benzyl-L-glutamate), involved first the preparation of in-chain polybutadiene functionalized with an amine group, followed by the ROP of γ-benzyl-L-glutamete N-carboxy anhydride to produce the hybrid miktoarm copolymer. All manipulations were performed under high vacuum in glass reactors, equipped with break-seals, glass-covered magnets, and constrictions, for the addition of reagents and removal of the intermediate products following well-established high vacuum techniques. The polymer characterization was carried out at each step of the synthesis using 1H-NMR and multi-detector size exclusion chromatography.

Task 9.3: New Production processes for polymers with architecture

Among the non-linear polymers, cyclic polymers were taken as an example. At the beginning of the work, a method was established to synthesize cyclic polyethylene glycol from the linear precursor material. Classical high dilution techniques were used. The raw product contained large quantities of higher molecular weight linear and cyclic by-products, together with linear precursor. The higher molecular weight structures could be removed by classical fractionation using a solvent/non–solvent pair. The linear precursor could be removed by oxidizing the alcoholic end groups to carboxylic acid groups. This method allowed separating the residual linear material by ion exchange chromatography. Sample quantities of 10g could be obtained. Meanwhile, the molecular weight range was extended to 20.000 g/mol. The removal of the oxidized linear precursor gets more difficult with increasing target molecular weight. Therefore the selection of the right ion exchange resin is of crucial importance for the complete removal of the linear material. It was found that especially the use of resins with particle sizes in the micrometer range improves the purification efficiency.

Potential Impact

The major achievement of ESMI is the true integration of European soft matter science in three directions: building networks across scientific disciplines, connecting different research methodologies and bridging academia with industry. This will continue to have a significant synergy effect on soft matter research and so strengthen Europe's position in a field which, in the light of developing soft nano-technology and biophysical applications, will become more and more important in the future.

The high involvement of industry, both of ESMI partners and companies external to ESMI, in all activities will increase the level of basic understanding of soft matter properties among industrial researchers. This will enhance the options for knowledge-based rational design of materials and

products and consequently result in a more effective use of resources and increased environmental sustainability.

Transnational access activities

The ESMI transnational access activities offered synthesis as well as experimental and computational possibilities, which were unattainable or even unknown to individual scientists or even to entire communities. With the support of the facilities' local contacts, also non-expert users were enabled to acquire, thoroughly analyse, and interpret data at a specialist level. Due to the network nature of this distributed infrastructure with its variety of facilities, researchers could design interdependent and mutually supplemental approaches to tackle a scientific problem, which is significant added value compared with a single sited infrastructure. All these aspects add up to a competitive advantage for European soft matter scientists helping to consolidate the ERA's leadership in the development and investigation of new soft matter materials.

The broad spectrum of methods and techniques offered by ESMI or a potential follow up research infrastructure could attract new user communities. A plethora of biophysical problems could be tackled with the aid of ESMI facilities which provides European scientists with unprecedented research options in a highly competitive field. An increased usage of ESMI facilities by industrial researchers will in the short term help to enhance their capabilities for rational product design. In the medium and long term, this will increase the innovation potential of European industries, such as those producing food or personal care products, and enable them to hold on to or improve their position in the global market.

A sizable fraction of the access granted under ESMI was allocated to researchers from south-eastern European countries. With this, ESMI will add to a strengthening of the research landscape in these countries, which will contribute to the economical harmonization of these regions with northern Europe

Joint research activities

ESMI JRAs contributes to the integration and harmonization of the scientific endeavour of leading European groups. This bundles together expertise, reduces internal competition and avoids duplication of work. This ensures a more efficient use of resources and faster results. Additionally, co-operation across disciplines leads to a mutual fertilization of research fields and together with high industry involvement, this enables fast knowledge transfer and improves innovation potential.

By nature, the main impact of JRAs will be scientific. The efforts to explore new routes for the synthesis of soft matter systems will provide the community with a wealth of systems and materials which may have novel features, ranging from inorganic particulate materials providing completely new options to tune optical material properties, to polymer/protein hybrid materials which combine the availability of large quantities of synthetic polymers with biological functions.

The development of new experimental methods, sample environments and simulation algorithms will expand the range of techniques which are nowadays available to a significant extent, which will lead to unimagined research techniques. An example of this would be the work performed for the optimization of transmission electron microscopy to investigate soft matter. At the beginning of ESMI, 3D reconstructions of soft matter material from tomographic TEM observation were unknown. Through the ESMI JRA, they are now available, and have the potential to revolutionise the imaging of biological material.

Networking activities

The ESMI networking activities can be coarsely grouped into training and education efforts on the one hand and dissemination and communication activities on the other.

The continued education of young scientists and training of users has been provided through a series of themed workshops and laboratory courses as well as by user training at the hosting TNA facility. Participants will benefit from these activities by increasing employability and improved career options. Academic and industrial employers will find a group of well trained researchers with specialized experience in soft matter science. This will help the European research area to take a leading role in the field of soft matter. The participation of industrial partners ensures the consideration of the industrial dimension of research and training. Therefore, ESMI training and education activities help to bridge the industry-academia gap in a field where a high level of innovation is expected in the coming years. Through ESMI's efforts to train researchers already in employment or young scientists trained through ESMI activities, European industry has access to a number of highly-skilled scientists equipped to lead the way to further innovations.

The results and foreground obtained from ESMI research activities were and will be disseminated in over hundred sixty publications in peer reviewed scientific journals, presentations and posters at international scientific conferences, seminars, colloquia and in university lectures in the long term. By this, ESMI will contribute to making the Innovation Union a reality, which is a central part of the Europe 2020 strategy [1,2]. Dissemination of research results is an important basic for innovation, thus ESMI will help to strengthen European leadership in a key field important for a plethora of applications.

[1] Europe 2020: "A strategy for smart, sustainable and inclusive growth", COM(2010) 2020, Brussels, 03/03/2010.

[2] Europe 2020: "Flagship Initiative Innovation Union", COM(2010) 546, Brussels, 03/03/2010.

Gender Support activities

ESMI set-up a gender support programme with the aim of increasing the participation of women in natural sciences. Apart from promoting equal opportunities for women in general, this activity will also lead to a more efficient employment of human resources. This contributes to reducing the

European skills shortage in the natural sciences and in technical fields by increasing the participation of women in science.

4.2 Use and dissemination of foreground

The main purpose of ESMI was to provide transnational access to infrastructure for the community of European soft mater scientists. Furthermore, it was planned to develop existing infrastructure by joint research efforts. Consequently, the foreground produced by ESMI is mainly of a scientific nature, and only in rare cases is commercial exploitation feasible.

Section A: Dissemination of foreground

The results and foreground obtained from ESMI research activities were and will be disseminated through over a hundred sixty publications in peer-reviewed scientific journals, presentations and posters at international scientific conferences, seminars, colloquia and in university lectures in the long term. In the first place, these activities are targeted at the community of soft matter scientist from academia and industry alike and to students of physics, chemistry, material sciences, bio-physics and related subjects. Since dissemination of fundamental research results is an important basic for technological progress and innovation, ESMI makes an important contribution to making the Innovation Union a reality, which is a central part of the Europe 2020 strategy [1,2]. In the long term, foreground disseminated by ESMI will enhance the basic understanding of soft matter materials, thus opening a new route for the rational design of soft matter based products, a more efficient use of resources, and also environmental sustainability. Eventually this will help European industries, such as those producing food or personal care products, to hold on to or improve their position in the global market.

[1] Europe 2020: “A strategy for smart, sustainable and inclusive growth", COM(2010) 2020, Brussels, 03/03/2010.

[2] Europe 2020: “Flagship Initiative Innovation Union", COM(2010) 546, Brussels, 03/03/2010.

All the ESMI dissemination activities up to the date of this report are detailed in the Table template A1 below.

TEMPLATE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES								
№	**Title**	**First author**	**Title of the periodical or the series**	**Number, date or frequency**	**Date of publication**	**Relevant pages**	**DOI**	**Is/Will open access provided to this publication?**
1	Evanescent-wave and ambient chiral sensing by signal-reversing cavity ringdown polarimetry	Dimitris Sofikitis	Nature	Vol. 514/Issue 7520	10.09.2014	76-79	10.1038/nature13680	
2	Atomic-scale determination of surface facets in gold nanorods	Bart Goris	Nature Materials	Vol. 11/Issue 11	21.10.2012	930-935	10.1038/nmat3462	
3	Long-range orientation and atomic attachment of nanocrystals in 2D honeycomb superlattices	M. P. Boneschanscher	Science	Vol. 344/Issue 6190	20.06.2014	1377-1380	10.1126/science.1252642	
4	All-In-One Optical Heater-Thermometer Nanoplatform Operative From 300 to 2000 K Based on Er	Mengistie L. Debasu	Advanced Materials	Vol. 25/Issue 35	20.09.2013	4868-4874	10.1002/adma.201300892	

5	Enhanced Self-Assembly of Metal Oxides and Metal-Organic Frameworks from Precursors with Magnetohydrodynamically Induced Long-Lived Collective Spin States	Eric Breynaert	Advanced Materials	Vol. 26/Issue 30	01.08.2014	5173-5178	10.1002/adma.201400835	
6	Three-Dimensional Elemental Mapping at the Atomic Scale in Bimetallic Nanocrystals	Bart Goris	Nano Letters	Vol. 13/Issue 9	11.09.2013	4236-4241	10.1021/nl401945b	
7	Low-Dimensional Semiconductor Superlattices Formed by Geometric Control over Nanocrystal Attachment	Wiel H. Evers	Nano Letters	Vol. 13/Issue 6	12.06.2013	2317-2323		
8	Monitoring Galvanic Replacement Through Three-Dimensional Morphological and Chemical Mapping	Bart Goris	Nano Letters	na	08.05.2014	1.4051E+14	10.1021/nl500593j	
9	Unveiling Nanometer Scale Extinction and Scattering Phenomena through Combined Electron Energy Loss Spectroscopy and Cathodoluminescence Measurements	Arthur Losquin	Nano Letters	Vol. 15/Issue 2	11.02.2015	1229-1237	10.1021/nl5043775	

10	Controlled Living Nanowire Growth: Precise Control over the Morphology and Optical Properties of AgAuAg Bimetallic Nanowires	Martin Mayer	Nano Letters	Vol. 15/Issue 8	12.08.2015	5427-5437	10.1021/acs.nanolett.5b01833	Yes
11	Measuring Lattice Strain in Three Dimensions through Electron Microscopy	Bart Goris	Nano Letters	Vol. 15/Issue 10	14.10.2015	6996-7001	10.1021/acs.nanolett.5b03008	
12	Low-Dimensional Semiconductor Superlattices Formed by Geometric Control over Nanocrystal Attachment	Wiel H. Evers	Nano Letters	Vol. 13/Issue 6	12.06.2013	2317-2323	10.1021/nl303322k	
13	Atomic Resolution Monitoring of Cation Exchange in CdSe-PbSe Heteronanocrystals during Epitaxial Solid–Solid–Vapor Growth	Anil O. Yalcin	Nano Letters	Vol. 14/Issue 6	11.06.2014	3661-3667	10.1021/nl501441w	
14	Three-Dimensional Atomic Imaging of Colloidal Core–Shell Nanocrystals	Sara Bals	Nano Letters	Vol. 11/Issue 8	10.08.2011	3420-3424	10.1021/nl201826e	
15	Steric Hindrance Induces crosslike Self-Assembly of Gold Nanodumbbells	Marek Grzelczak	Nano Letters	Vol. 12/Issue 8	08.08.2012	4380-4384	10.1021/nl3021957	
16	Hydrophobic interactions modulate self-assembly of nanoparticles	Sanchez-Iglesias, A.	ACS Nano	6	28.11.2012	11059-11065		

17	Tailoring ZnSe–CdSe Colloidal Quantum Dots	Esther Groeneveld	ACS Nano	Vol. 7/Issue 9	24.09.2013	7913-7930	10.1021/nn402931y	
18	Self-Organization of Highly Symmetric Nanoassemblies: A Matter of Competition	Jesus E. Galván-Moya	ACS Nano	Vol. 8/Issue 4	22.04.2014	3869-3875	10.1021/nn500715d	
19	Polyethylene Glycol Conjugated Polymeric Nanocapsules for Targeted Delivery of Quercetin to Folate-Expressing Cancer Cells	Riham I. El-Gogary	ACS Nano	Vol. 8/Issue 2	25.02.2014	1384-1401	10.1021/nn405155b	
20	Competing Forces in the Self-Assembly of Coupled ZnO Nanopyramids	Elsa Javon	ACS Nano	Vol. 9/Issue 4	28.04.2015	3685-3694	10.1021/acsnano.5b00809	
21	Knitting the Catalytic Pattern of Artificial Photosynthesis to a Hybrid Graphene Nanotexture	Mildred Quintana	ACS Nano	Vol. 7/Issue 1	22.01.2013	811-817	10.1021/nn305313q	
22	Hydrophobic Interactions Modulate Self-Assembly of Nanoparticles	Ana Sánchez-Iglesias	ACS Nano	Vol. 6/Issue 12	21.12.2012	11059-11065	10.1021/nn3047605	No
23	GaN@ZIF-8: Selective Formation of Gallium Nitride Quantum Dots inside a Zinc Methylimidazolate Framework	Daniel Esken	Journal of the American Chemical Society	Vol. 133/Issue 41	19.10.2011	16370-16373	10.1021/ja207077u	

24	Copper Benzene Tricarboxylate Metal–Organic Framework with Wide Permanent Mesopores Stabilized by Keggin Polyoxometallate Ions	Lik H. Wee	Journal of the American Chemical Society	Vol. 134/Issue 26	04.07.2012	10911-10919	10.1021/ja302089w	
25	Three-Dimensional Characterization of Noble-Metal Nanoparticles and their Assemblies by Electron Tomography	Sara Bals	Angewandte Chemie - International Edition	Vol. 53/Issue 40	26.09.2014	10600-10610	10.1002/anie.201401059	
26	Tunable White-Light Emission from Conjugated Polymer-Di-Ureasil Materials	Niamh Willis-Fox	Advanced Functional Materials	Vol. 26/Issue 4	26.01.2016	532-542	10.1002/adfm.201504017	No
27	Accumulation of Formamide in Hydrothermal Pores to Form Prebiotic Nucleobases	D. Niether	Proceedings of the National Academy of Sciences of the United States	under review	01.05.2016	under review		Yes
28	Synergistic photoluminescence enhancement in conjugated polymer-di-ureasil organic–inorganic composites	Niamh Willis-Fox	Chemical Science	Vol. 6/Issue 12	01.01.2015	7227-7237	10.1039/C5SC02409A	
29	Synthesis of Highly Luminescent Silica-Coated	Francesca Pietra	Chemistry of Materials	Vol. 25/Issue	10.09.2013	3427-3434	dx.doi.org/10.1021/cm401169t	

	CdSe/CdS Nanorods			17				
30	Seedless Synthesis of Single Crystalline Au Nanoparticles with Unusual Shapes and Tunable LSPR in the near-IR	Paula C. Angelomé	Chemistry of Materials	Vol. 24/Issue 7	10.04.2012	1393-1399	10.1021/cm3004479	Yes
31	Engineering Structural Diversity in Gold Nanocrystals by Ligand-Mediated Interface Control	Yusong Wang	Chemistry of Materials	Vol. 27/Issue 23	08.12.2015	8032-8040	10.1021/acs.chemmater.5b03600	
32	Synthesis of Highly Luminescent Silica-Coated CdSe/CdS Nanorods	Francesca Pietra	Chemistry of Materials	Vol. 25/Issue 17	10.09.2013	3427-3434	10.1021/cm401169t	
33	Luminescent CuInS 2 Quantum Dots by Partial Cation Exchange in Cu 2– x S Nanocrystals	Ward van der Stam	Chemistry of Materials	Vol. 27/Issue 2	27.01.2015	621-628	10.1021/cm504340h	
34	Convective Cage Release in model colloidal glasses	Jacob AR	Physical Review Letters	115	17.11.2015	218301	10.1103/PhysRevLett.115.218301	
35	Residual Stresses in Glasses	M. Ballauff	Physical Review Letters	Vol. 110/Issue 21	01.05.2013	215701	10.1103/PhysRevLett.110.215701	
36	Complex Oscillatory Yielding of Model Hard-Sphere Glasses	N. Koumakis	Physical Review Letters	Vol. 110/Issue 17	01.04.2013	178301	10.1103/PhysRevLett.110.178301	

37	Molecular Scale Dynamics of Large Ring Polymers	S. Gooßen	Physical Review Letters	Vol. 113/Issue 16	01.10.2014	168302	10.1103/PhysRevLett.113.168302	
38	Evidence for Metal–Support Interactions in Au Modified TiO	Bastian Mei	ACS Catalysis	Vol. 3/Issue 12	06.12.2013	3041-3049	10.1021/cs400964k	
39	Sedimentation of single red blood cells	Matti Peltomäki	Soft Matter	Vol. 9/Issue 34	01.01.2013	8346	10.1039/c3sm50592h	
40	Fluorescent Nanodiamonds: Fluorescent Nanodiamonds Embedded in Biocompatible Translucent Shells (Small 6/2014)	Ivan Rehor	Small	Vol. 10/Issue 6	01.03.2014	1029-1029	10.1002/smll.201470033	
41	Fluorescent Nanodiamonds Embedded in Biocompatible Translucent Shells	Ivan Rehor	Small	Vol. 10/Issue 6	01.03.2014	1106-1115	10.1002/smll.201302336	
42	Stabilization and Encapsulation of Gold Nanostars Mediated by Dithiols	Yusong Wang	Small	Vol. 11/Issue 34	01.09.2015	4314-4320	10.1002/smll.201500703	
43	Controlled Hydrogel Fiber Formation: The Unique Case of Hexaphenylbenzene-Poly(ethylene glycol) Amphiphiles	Katrin Wunderlich	Small	Vol. 10/Issue 10	01.05.2014	1914-1919	10.1002/smll.201302832	

44	Thermally Induced Structural and Morphological Changes of CdSe/CdS Octapods	Bart Goris	Small	Vol. 8/Issue 6	26.03.2012	937-942	10.1002/smll.201101897	
45	Au@Ag Nanoparticles: Halides Stabilize {100} Facets	Sergio Gómez-Graña	Journal of Physical Chemistry Letters	Vol. 4/Issue 13	03.07.2013	2209-2216	10.1021/jz401269w	
46	A protecting group approach toward synthesis of Au–silica Janus nanostars	Denis Rodríguez-Fernández	Chemical Communications	Vol. 50/Issue 1	01.01.2013	79	10.1039/c3cc47531j	
47	Governing the morphology of Pt–Au heteronanocrystals with improved electrocatalytic performance	Stefanos Mourdikoudis	Nanoscale	Vol. 7/Issue 19	01.01.2015	8739-8747	10.1039/C4NR07481E	Yes
48	Multifunctional self-assembled composite colloids and their application to SERS detection	Andrea La Porta	Nanoscale	Vol. 7/Issue 23	01.01.2015	10377-10381	10.1039/C5NR01264C	Yes
49	Quantitative 3D analysis of huge nanoparticle assemblies	Daniele Zanaga	Nanoscale	Vol. 8/Issue 1	01.01.2016	292-299	10.1039/C5NR06962A	
50	Characterizing nanoparticles in complex biological media and physiological fluids with depolarized dynamic light	S. Balog	Nanoscale	Vol. 7/Issue 14	01.01.2015	5991-5997	10.1039/c4nr06538g	No

	scattering							
51	Multifunctional self-assembled composite colloids and their application to SERS detection	Andrea La Porta	Nanoscale	Vol. 7/Issue 23	01.01.2015	10377-10381	10.1039/C5nr01264c	
52	Dimethylformamide-mediated synthesis of water-soluble platinum nanodendrites for ethanol oxidation electrocatalysis	Stefanos Mourdikoudis	Nanoscale	Vol. 5/Issue 11	01.01.2013	4776	10.1039/c3nr00924f	
53	Governing the morphology of Pt–Au heteronanocrystals with improved electrocatalytic performance	Stefanos Mourdikoudis	Nanoscale	Vol. 7/Issue 19	01.01.2015	8739-8747	10.1039/C4nr07481e	
54	Local boron environment in B-doped nanocrystalline diamond films	Stuart Turner	Nanoscale	Vol. 4/Issue 19	01.01.2012	5960	10.1039/c2nr31530k	
55	Heat-induced transformation of CdSe–CdS–ZnS core–multishell quantum dots by Zn diffusion into inner layers	Anil O. Yalcin	Chemical Communications	Vol. 51/Issue 16	01.01.2015	3320-3323	10.1039/C4cc08647c	

56	Lewis base mediated efficient synthesis and solvation-like host–guest chemistry of covalent organic framework-1	Suresh Babu Kalidindi	Chemical Communications	Vol. 49/Issue 5	01.01.2013	463-465	10.1039/c2cc37183a	
57	Photocrosslinkable dextran hydrogel films as substrates for osteoblast and endothelial cell growth	A. Brunsen	Journal of Materials Chemistry	Vol. 22/Issue 37	01.01.2012	19590	10.1039/C2JM34006B	
58	Bloch surface wave-enhanced fluorescence biosensor	Koji Toma	Biosensors and Bioelectronics	Vol. 43	01.05.2013	108-114	10.1016/j.bios.2012.12.001	
59	Dynamical and rheological properties of soft colloid suspensions	Roland G. Winkler	Current Opinion in Colloid and Interface Science	Vol. 19/Issue 6	01.12.2014	594-610	10.1016/j.cocis.2014.09.005	
60	Dynamical and Rheological Properties of Ultrasoft Colloids under Shear Flow	Sunil P. Singh	Macromolecules	Vol. 46/Issue 19	08.10.2013	8026-8036	10.1021/ma401571k	
61	Study of the Dynamic Heterogeneity in Poly(ethylene-	Mohammed M. Kummali	Macromolecules	Vol. 46/Issue 18	24.09.2013	7502-7512	10.1021/ma4012522	
62	Dynamics of Branched Polymers: A Combined Study by Molecular Dynamics Simulations and Tube Theory	Petra Bačová	Macromolecules	Vol. 46/Issue 11	11.06.2013	4633-4650	10.1021/ma4005988	No

63	Real-Space Analysis of Branch Point Motion in Architecturally Complex Polymers	Petra Bačová	Macromolecules	Vol. 47/Issue 19	14.10.2014	6955-6963	10.1021/ma501405n	No
64	Investigation of Water Diffusion Mechanisms in Relation to Polymer Relaxations in Polyamides	Florentina-Maria Preda	Macromolecules	Vol. 48/Issue 16	25.08.2015	5730-5741	10.1021/acs.macromol.5b01295	No
65	Thin Hydrogel Films for Optical Biosensor Applications	Anca Mateescu	Membranes	Vol. 2/Issue 4	01.12.2012	40-69	10.3390/membranes2010040	
66	Synthesis and Linear Viscoelasticity of Polystyrene Stars with a Polyketone Core	L. M. Polgar	Macromolecules	Vol. 48/Issue 18	22.09.2015	6662-6671	10.1021/acs.macromol.5b01434	
67	Effects of Core Microstructure on Structure and Dynamics of Star Polymer Melts: From Polymeric to Colloidal Response	Frank Snijkers	Macromolecules	Vol. 47/Issue 15	12.08.2014	5347-5356	10.1021/ma5008336	
68	Branch-Point Motion in Architecturally Complex Polymers: Estimation of Hopping Parameters from Computer Simulations and Experiments	Petra Bačová	Macromolecules	Vol. 47/Issue 10	27.05.2014	3362-3377	10.1021/ma5003936	
69	Self-Organized Structures of Attractive End-Functionalized	Jin Suk Myung	Macromolecules	Vol. 47/Issue	24.06.2014	4118-4125	10.1021/ma500731d	

	Semiflexible Polymer Suspensions			12				
70	Scaffold Structures by Telechelic Rodlike Polymers: Nonequilibrium Structural and Rheological Properties under Shear Flow	Farzaneh Taslimi	Macromolecules	Vol. 47/Issue 19	14.10.2014	6946-6954	10.1021/ma501215t	
71	Hydrolytically Degradable Polymer Micelles for Drug Delivery: A SAXS/SANS Kinetic Study	Sergey K. Filippov	Biomacromolecules	Vol. 14/Issue 11	11.11.2013	4061-4070	10.1021/bm401186z	
72	Self-Assembly of a Model Peptide Incorporating a Hexa-Histidine Sequence Attached to an Oligo-Alanine Sequence, and Binding to Gold NTA/Nickel Nanoparticles	Ian W. Hamley	Biomacromolecules	Vol. 15/Issue 9	08.09.2014	3412-3420	10.1021/bm500950c	
73	Incorporation of Pure Fullerene into Organoclays: Towards C 60 -Pillared Clay Structures	Theodoros Tsoufis	Chemistry - A European Journal	Vol. 19/Issue 24	10.06.2013	7937-7943	10.1002/chem.201300164	
74	Metal@COFs: Covalent Organic Frameworks as Templates for Pd Nanoparticles and Hydrogen Storage Properties of Pd@COF-	Suresh Babu Kalidindi	Chemistry - A European Journal	Vol. 18/Issue 35	27.08.2012	10848-10856	10.1002/chem.201201340	No

	102 Hybrid Material							
75	Free Energies by Thermodynamic Integration Relative to an Exact Solution, Used to Find the Handedness-Switching Salt Concentration for DNA	Joshua T. Berryman	Journal of Chemical Theory and Computation	Vol. 9/Issue 1	08.01.2013	679-686	10.1021/ct3005968	
76	Viscosity of Ring Polymer Melts	Rossana Pasquino	ACS Macro Letters	Vol. 2/Issue 10	15.10.2013	874-878	10.1021/mz400344e	
77	Creep and flow of glasses: strain response linked to the spatial distribution of dynamical heterogeneities	T. Sentjabrskaja	Scientific Reports	Vol. 5	08.07.2015	11884	10.1038/srep11884	Yes
78	Plasmon Mapping in Au@Ag Nanocube Assemblies	Bart Goris	Journal of Physical Chemistry C	Vol. 118/Issue 28	17.07.2014	15356-15362	10.1021/jp502584t	Yes
79	Dynamic Depolarized Light Scattering of Small Round Plasmonic Nanoparticles: When Imperfection is Only Perfect	Sandor Balog	Journal of Physical Chemistry C	Vol. 118/Issue 31	07.08.2014	17968-17974	10.1021/jp504264f	No
80	Active Control of SPR by Thermoresponsive Hydrogels for Biosensor Applications	Mana Toma	Journal of Physical Chemistry C	Vol. 117/Issue 22	06.06.2013	11705-11712	10.1021/jp400255u	

81	Sterically Stabilized Colloids with Tunable Repulsions	Kitty van Gruijthuijsen	Langmuir	Vol. 29/Issue 36	10.09.2013	11199-11207	10.1021/la402104q	
82	Multilamellar Vesicle Formation from a Planar Lamellar Phase under Shear Flow	Luigi Gentile	Langmuir	Vol. 30/Issue 28	22.07.2014	8316-8325	10.1021/la501071s	No
83	Docetaxel-Loaded Fluorescent Liquid-Crystalline Nanoparticles for Cancer Theranostics	Valeria Meli	Langmuir	Vol. 31/Issue 35	08.09.2015	9566-9575	10.1021/acs.langmuir.5b02101	No
84	Simultaneous Measurement of Mechanical and Surface Properties in Thermoresponsive, Anchored Hydrogel Films	Kathryn A. Melzak	Langmuir	Vol. 28/Issue 35	04.09.2012	12871-12878	10.1021/la3019666	
85	A high-temperature dielectric process as a probe of large-scale silica filler structure in simplified industrial nanocomposites	Guilhem P. Baeza	Physical Chemistry Chemical Physics	Vol. 17/Issue 3	01.01.2015	1660-1666	10.1039/C4CP04597A	No
86	On the self-assembly of a tryptophan labeled deoxycholic acid	Leana Travaglini	Physical Chemistry Chemical Physics	Vol. 16/Issue 36	01.01.2014	19492	10.1039/c4cp02371d	No
87	Photoswitching the mechanical properties in Langmuir layers of semifluorinated alkyl-	Antigoni Theodoratou	Physical Chemistry Chemical Physics	Vol. 17/Issue 43	01.01.2015	28844-28852	10.1039/C5CP04242A	

	azobenzenes at the air–water interface							
88	New routes to food gels and glasses	Thomas Gibaud	Faraday Discussions	Vol. 158	01.01.2012	267	10.1039/C2FD20048A	No
89	Slip of gels in colloid–polymer mixtures under shear	Pierre Ballesta	Soft Matter	Vol. 9/Issue 12	01.01.2013	3237	10.1039/c3sm27626k	
90	Phase behaviour of colloids with short-range repulsions plus nonadsorbing polymer chains	Kitty van Gruijthuijsen	Soft Matter	Vol. 9/Issue 42	01.01.2013	9977	10.1039/c3sm51432c	
91	Electrical double layer in ionic liquids: Structural transitions from multilayer to monolayer structure at the interface	K. Kirchner	Electrochimica Acta	Vol. 110	01.11.2013	762-771	10.1016/j.electacta.2013.05.049	
92	Transient dynamics during stress overshoots in binary colloidal glasses	T. Sentjabrskaja	Soft Matter	10	11.06.2014	6546-6555	10.1039/c4sm00577e	Yes
93	Near-wall dynamics of concentrated hard-sphere suspensions: comparison of evanescent wave DLS experiments, virial approximation and simulations	Yi Liu	Soft Matter	Vol. 11/Issue 37	01.01.2015	7316-7327	10.1039/c5sm01624j	Yes

94	Tuning colloidal gels by shear	Nick Koumakis	Soft Matter	Vol. 11/Issue 23	01.01.2015	4640-4648	10.1039/C5SM00411J	
95	Yielding of binary colloidal glasses	T. Sentjabrskaja	Soft Matter	Vol. 9/Issue 17	01.01.2013	4524	10.1039/C3SM27903K	
96	Molecular rheology of branched polymers: decoding and exploring the role of architectural dispersity through a synergy of anionic synthesis, interaction chromatography, rheometry and modeling	E. van Ruymbeke	Soft Matter	Vol. 10/Issue 27	01.01.2014	4762	10.1039/C4SM00105B	
97	Compact structure and non-Gaussian dynamics of ring polymer melts	Ana R. Brás	Soft Matter	Vol. 10/Issue 20	01.01.2014	3649-3655	10.1039/c3sm52717d	
98	Coarse grain forces in star polymer melts	L. Liu	Soft Matter	Vol. 10/Issue 39	01.01.2014	7874-7886	10.1039/C4SM00767K	
99	Grain size tuning of nanocrystalline chemical vapor deposited diamond by continuous electrical bias growth: Experimental and theoretical study	Vincent Mortet	Physica Status Solidi (A) Applications and Materials	209	07.09.2012	675–168		

100	Small-angle X-ray scattering and light scattering study of hybrid nanoparticles composed of thermoresponsive triblock copolymer F127 and thermoresponsive statistical polyoxazolines with hydrophobic moieties	Anna Bogomolova	Journal of Applied Crystallography	Vol. 46/Issue 6	01.12.2013	1690-1698	10.1107/S0021889813027064	
101	Scanning SAXS–WAXS microscopy on osteoarthritis-affected bone – an age-related study	C. Giannini	Journal of Applied Crystallography	Vol. 47/Issue 1	01.02.2014	110-117	10.1107/S1600576713030215	
102	Quantitative Structure Determination of Large Three-Dimensional Nanoparticle Assemblies	Thomas Altantzis	Particle and Particle Systems Characterization	Vol. 30/Issue 1	01.01.2013	84-88	10.1002/ppsc.201200045	No
103	Grain size tuning of nanocrystalline chemical vapor deposited diamond by continuous electrical bias growth: Experimental and theoretical study	Vincent Mortet	Physica Status Solidi (A) Applications and Materials	Vol. 209/Issue 9	01.09.2012	1675-1682	10.1002/pssa.201200581	
104	Carbon-Dot-Decorated Nanodiamonds	Olga Shenderova	Particle and Particle Systems Characterization	Vol. 31/Issue 5	01.05.2014	580-590	10.1002/ppsc.201300251	

105	Aberration-corrected microscopy and spectroscopy analysis of pristine, nitrogen containing detonation nanodiamond	Stuart Turner	Physica Status Solidi (A) Applications and Materials	Vol. 210/Issue 10	01.10.2013	1976-1984	10.1002/pssa.201300315	
106	Local mechanical and dielectric behavior of the interacting polymer layer in silica nano-particles filled SBR by means of AFM-based methods	Mohammed M. Kummali	Polymer	Vol. 54/Issue 18	01.08.2013	4980-4986	10.1016/j.polymer.2013.07.032	
107	Depercolation of aggregates upon polymer grafting in simplified industrial nanocomposites studied with dielectric spectroscopy	Guilhem P. Baeza	Polymer	Vol. 73	01.09.2015	131-138	10.1016/j.polymer.2015.07.045	No
108	A general approach toward polymer-coated plasmonic nanostructures	Marek Grzelczak	CrystEngComm	Vol. 16/Issue 40	01.01.2014	9425-9429	10.1039/C4CE00724G	Yes
109	Single-step alcohol-free synthesis of core–shell nanoparticles of β-casein micelles and silica	Stef Kerkhofs	RSC Advances	Vol. 4/Issue 49	01.01.2014	25650	10.1039/c4ra03252g	
110	Procedure to count atoms with trustworthy single-atom sensitivity	S. Van Aert	Physical Review B - Condensed Matter and Materials Physics	Vol. 87/Issue 6	01.02.2013	64107	10.1103/PhysRevB.87.064107	

111	Numerical study of the lateral resolution in electrostatic force microscopy for dielectric samples	C Riedel	Nanotechnology	Vol. 22/Issue 28	15.07.2011	285705	10.1088/0957-4484/22/28/285705	No
112	Contrast inversion in electrostatic force microscopy imaging of trapped charges: tip–sample distance and dielectric constant dependence	C Riedel	Nanotechnology	Vol. 22/Issue 34	26.08.2011	345702	10.1088/0957-4484/22/34/345702	No
113	Glycogen as a Biodegradable Construction Nanomaterial for in vivo Use	Sergey K. Filippov	Macromolecular Bioscience	Vol. 12/Issue 12	01.12.2012	1731-1738	10.1002/mabi.201200294	No
114	Biosensor based on hydrogel optical waveguide spectroscopy for the detection of 17β-estradiol	Qingwen Zhang	Talanta	Vol. 104	01.01.2013	149-154	10.1016/j.talanta.2012.11.017	
115	On the use of electrostatic force microscopy as a quantitative subsurface characterization technique: A numerical study	C. Riedel	Applied Physics Letters	Vol. 99/Issue 2	01.01.2011	23101	10.1063/1.3608161	No

116	Local bond length variations in boron-doped nanocrystalline diamond measured by spatially resolved electron energy-loss spectroscopy	Ying-Gang Lu	Applied Physics Letters	Vol. 103/Issue 3	01.01.2013	32105	10.1063/1.4813842	
117	Fluorescent Nanodiamonds with Bioorthogonally Reactive Protein-Resistant Polymeric Coatings	Ivan Rehor	ChemPlusChem	Vol. 79/Issue 1	01.01.2014	21-24	10.1002/cplu.201300339	
118	Self-Assembly and Formation of Chromonic Liquid Crystals from the Dyes Quinaldine Red Acetate and Pyronin Y	J. R. Magana	Journal of Physical Chemistry B	Vol. 120/Issue 1	14.01.2016	250-258	10.1021/acs.jpcb.5b10567	No
119	Phase Coexistence in a Dynamic Phase Diagram	Luigi Gentile	ChemPhysChem	Vol. 16/Issue 11	03.08.2015	2459-2465	10.1002/cphc.201500237	No
120	Dynamic Phase Diagram of a Nonionic Surfactant Lamellar Phase	Luigi Gentile	Journal of Physical Chemistry B	Vol. 118/Issue 13	03.04.2014	3622-3629	10.1021/jp5009797	
121	Multimodal imaging of micron-sized iron oxide particles following	Dimitri Roose	Contrast Media and Molecular Imaging	online	01.04.2014	n/a-n/a	10.1002/cmmi.1594	
122	Predicting the apparent wall slip when using roughened geometries: A porous medium approach	Claudia Carotenuto	Journal of Rheology	Vol. 59/Issue 5	01.09.2015	1131-1149	10.1122/1.4923405	

123	Plastic rearrangements in colloidal gels investigated by LAOS and LS-Echo	M. Laurati	Journal of Rheology	Vol. 58/Issue 5	01.09.2014	1395-1417	10.1122/1.4872059	
124	Depletion gels from dense soft colloids: Rheology and thermoreversible melting	Domenico Truzzolillo	Journal of Rheology	Vol. 58/Issue 5	01.09.2014	1441-1462	10.1122/1.4866592	
125	Hydrogen adsorption properties of platinum decorated hierarchically structured templated carbons	Hyunchul Oh	Microporous and Mesoporous Materials	Vol. 177	01.09.2013	66-74	10.1016/j.micromeso.2013.04.020	
126	Zeolite β nanoparticles based bimodal structures: Mechanism and tuning of the porosity and zeolitic properties	Cynthia J. Van Oers	Microporous and Mesoporous Materials	Vol. 185	01.02.2014	204-212	10.1016/j.micromeso.2013.11.021	
127	Neutron Crystallographic Studies Reveal Hydrogen Bond and Water-Mediated Interactions between a Carbohydrate-Binding Module and Its Bound Carbohydrate Ligand	S. Zoë Fisher	Biochemistry	Vol. 54/Issue 42	27.10.2015	6435-6438	10.1021/acs.biochem.5b01058	
128	Imaging of intact MOF-5 nanocrystals by advanced TEM at liquid nitrogen temperature	Christian Wiktor	Microporous and Mesoporous Materials	Vol. 162	01.11.2012	131-135	10.1016/j.micromeso.2012.06.014	

129	Structure formation of surfactant membranes under shear flow	Hayato Shiba	Journal of Chemical Physics	Vol. 139/Issue 1	01.01.2013	14702	10.1063/1.4811239	
130	One-particle correlation function in evanescent wave dynamic light scattering	Maciej Lisicki	Journal of Chemical Physics	Vol. 136/Issue 20	01.01.2012	204704	10.1063/1.4720069	
131	Anisotropic diffusion of concentrated hard-sphere colloids near a hard wall studied by evanescent wave dynamic light scattering	V. N. Michailidou	Journal of Chemical Physics	Vol. 139/Issue 16	01.01.2013	164905	10.1063/1.4825261	
132	A computational and experimental study of the linear and nonlinear response of a star polymer melt with a moderate number of unentangled arms	Barry W. Fitzgerald	Journal of Chemical Physics	Vol. 141/Issue 11	21.09.2014	114907	10.1063/1.4895610	
133	Effect of hydrodynamic correlations on the dynamics of polymers in dilute solution	Chien-Cheng Huang	Journal of Chemical Physics	Vol. 138/Issue 14	01.01.2013	144902	10.1063/1.4799877	
134	Mesoscale modeling of shear-thinning polymer solutions	I. S. Santos de Oliveira	Journal of Chemical Physics	Vol. 140/Issue 10	14.03.2014	104903	10.1063/1.4867787	

135	A computational and experimental study of the linear and nonlinear response of a star polymer melt with a moderate number of unentangled arms	Barry W. Fitzgerald	Journal of Chemical Physics	Vol. 141/Issue 11	21.09.2014	114907	10.1063/1.4895610	
136	Self-organization in suspensions of end-functionalized semiflexible polymers under shear flow	Jin Suk Myung	Journal of Chemical Physics	Vol. 143/Issue 24	28.12.2015	243117	10.1063/1.4933368	
137	The Effect of Protein PEGylation on Physical Stability in Liquid Formulation	Louise Stenstrup Holm	Journal of Pharmaceutical Sciences	Vol. 103/Issue 10	01.10.2014	3043-3054	10.1002/jps.24094	No
138	Novel poly(butylene succinate) nanocomposites containing strontium hydroxyapatite nanorods with enhanced osteoconductivity for tissue engineering applications	M. Nerantzaki	Express Polymer Letters	Vol. 9/Issue 9	24.06.2015	773-789	10.3144/expresspolymlett.2015.73	
139	AFM based dielectric spectroscopy: Extended frequency range through excitation of cantilever higher eigenmodes	Luis A. Miccio	Ultramicroscopy	Vol. 146	01.11.2014	55-61	10.1016/j.ultramic.2014.06.006	No

140	Electron tomography based on a total variation minimization reconstruction technique	B. Goris	Ultramicroscopy	Vol. 113	01.02.2012	120-130	10.1016/j.ultramic.2011.11.004	
141	A tryptophan-substituted cholic acid: Expanding the family of labelled biomolecules	Leana Travaglini	Colloids and Surfaces A: Physicochemical and Engineering Aspects	Vol. 483	01.10.2015	142-149	10.1016/j.colsurfa.2015.03.033	No
142	Jamming of cellulose ether solutions in porous medium	Claire Marlière	AICHE Journal	Vol. 61/Issue 11	01.11.2015	3923-3935	10.1002/aic.14920	
143	Dynamic Response of Anchored Poly(N -isopropylacrylamide- co -methacrylic acid- co -benzophenone methacrylate) Terpolymer Hydrogel Layers to Physicochemical Stimuli	Maria Gianneli	Macromolecular Chemistry and Physics	Vol. 216/Issue 3	01.02.2015	277-286	10.1002/macp.201400361	
144	Component dynamics in nanostructured PI-PDMS diblock copolymers with PI segregated in lamellas, cylinders and spheres	Angel Alegria	Colloid and Polymer Science	292	28.05.2014	1863–1876	10.1007/s00396-014-3255-3	No

145	Hydrodynamic correlations in multiparticle collision dynamics fluids	Chien-Cheng Huang	Physical Review E - Statistical, Nonlinear, and Soft Matter Physics	Vol. 86/Issue 5	01.11.2012	56711	10.1103/PhysRevE.86.056711	
146	Mesoscale Characterization of Supramolecular Transient Networks Using SAXS and Rheology	A. Pape	International Journal of Molecular Sciences	Vol. 15/Issue 1	01.01.2014	1096-1111	10.3390/ijms15011096	
147	Direct comparison of SESANS and SAXS to measure colloidal interactions	Kitty van Gruijthuijsen	Europhysics Letters	Vol. 106/Issue 2	01.04.2014	28002	10.1209/0295-5075/106/28002	No
148	Low-dose patterning of platinum nanoclusters on carbon nanotubes by focused-electron-beam-induced deposition as studied by TEM	Xiaoxing Ke	Beilstein Journal of Nanotechnology	Vol. 4	01.01.2013	77-86	10.3762/bjnano.4.9	
149	Heterometal nanoparticles from Ru-based molecular clusters covalently anchored onto functionalized carbon nanotubes and nanofibers	Deborah Vidick	Beilstein Journal of Nanotechnology	Vol. 6	01.01.2015	1287-1297	10.3762/bjnano.6.133	

150	Dielectric spectroscopy at the nanoscale by atomic force microscopy: A simple model linking materials properties and experimental response	Luis A. Miccio	Journal of Applied Physics	Vol. 115/Issue 18	14.05.2014	184305	10.1063/1.4875836	No
151	Effect of clay modification on structure–property relationships and thermal degradation kinetics of β-polypropylene/clay composite materials	Dimitrios G. Papageorgiou	Journal of Thermal Analysis and Calorimetry	Vol. 122/Issue 1	01.10.2015	393-406	10.1007/s10973-015-4705-y	
152	Near-field laser Doppler velocimetry measures near-wall velocities	B. Loppinet	European Physical Journal E	Vol. 35/Issue 7	01.07.2012	-	10.1140/epje/i2012-12062-5	
153	Viscoelasticity Sensor with Resonance Tuning and Low-Cost Interface	Erwin K. Reichel	Procedia Engineering	Vol. 25	01.01.2011	623-626	10.1016/j.proeng.2011.12.155	
154	Annular Dark-Field Transmission Electron Microscopyfor Low Contrast Materials	F. Leroux	Microscopy and Microanalysis	19	04.04.2013	629-634		
155	Superposition rheometry of a wormlike micellar fluid	Sunhyung Kim	Rheologica Acta	52	23.08.2013	727-740	10.1007/s00397-013-0718-2	Yes
156	Annular Dark-Field Transmission Electron Microscopy for Low Contrast Materials	F. Leroux	Microscopy and Microanalysis	Vol. 19/Issue 03	01.06.2013	629-634	10.1017/S1431927613000020	

157	Flow-induced crystallization studied in the RheoDSC device: Quantifying the importance of edge effects	Roozemond PC	Rheologica Acta	54	01.01.2015	01. Aug	10.1007/s00397-014-0820-0	
158	Flow of concentrated solutions of starlike micelles under large-amplitude oscillatory shear	Andreas S. Poulos	Rheologica Acta	Vol. 52/Issue 8-9	01.08.2013	785-800	10.1007/s00397-013-0703-9	
159	Appraisal of the Cox-Merz rule for well-characterized entangled linear and branched polymers	Frank Snijkers	Rheologica Acta	Vol. 53/Issue 12	01.12.2014	935-946	10.1007/s00397-014-0799-6	
160	DETERMINATION OF FILLER STRUCTURE IN SILICA-FILLED SBR COMPOUNDS BY MEANS OF SAXS AND AFM	Jon Otegui	Rubber Chemistry and Technology	Vol. 88/Issue 4	01.12.2015	690-710	10.5254/rct.15.84893	No
161	Soft-Glassy Rheology of Asphaltenes at Liquid Interfaces	Samaniuk, JR	Journal of Dispersion Science and Technology	36	02.04.2015	1444-1451	10.1080/01932691.2015.1022654	
162	A fixture for interfacial dilatational rheometry using a rotational rheometer	T. Verwijlen	European Journal of Physics	ST 222	17.06.2013	83-97	http://dx.doi.org/10.1140/epjst/e2013-01828-9	Yes

163	Crystallization, neutron data collection, initial structure refinement and analysis of a xyloglucan heptamer bound to an engineered carbohydrate-binding module from xylanase	Mats Ohlin	Acta Crystallographica Section F: Structural Biology and Crystallization Communications	Vol. 71/Issue 8	01.08.2015	1072-1077	10.1107/S2053230X15011383	
164	Influence of the Drude charge value on the performance of polarisable water model: A test for microscopic and macroscopic parameters	Aldi Asmadi	Journal of Molecular Liquids	Vol. 188	01.12.2013	245-251	10.1016/j.molliq.2013.09.026	

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES

№	Type of activities	Leading Partner	Title	Date/Period	Place / event	Tpye of audience	Size of audience	Countries addressed
1	Presentations	UNIVERSIDAD DE VIGO	Synthesis , assembly and applications of plasmonic nanoparticles	20.05.2011	Italian Institute of Technology Genova (Italy)	Scientific community (higher education, Research)		5
2	Presentations	UNIVERSIDAD DE VIGO	Shape-controlled Synthesis of Gold Nanoparticles	15.07.2010	University of Melbourne (Australia)	Scientific community (higher education, Research)		Canada
3	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Yielding of hard and soft colloidal glasses under large amplitude oscillatory shear	09.10.2011	83rd Annual Meeting Soc. of Rheology, Cleveland, USA 9-13 October 2011	Scientific community (higher education, Research)		20
4	Organisation of Conference	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	How do colloidal glasses and gels flow under shear	23.10.2011	Nano-S&T, BITs 1st Annual World Congress of Nano-S&T, 23-26 October 2011, Dalian, China	Scientific community (higher education, Research)		7

5	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Time evolution of Colloidal glasses under constant stress	09.10.2011	Society of Rheology 83nd Annual Meeting, Cleveland, USA, 9-13 October 2011	Scientific community (higher education, Research)		20
6	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Complex oscillatory yielding of simple hard sphere glasses	27.02.2012	APS, March meeting, 27 February 2 March, 2012, Boston, USA	Scientific community (higher education, Research)		10
7	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Shear induced diffusion in hard sphere glasses	27.02.2012	APS, March meeting, 27 February 2 March, 2012, Boston, USA	Scientific community (higher education, Research)		10
8	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Cyclic and multiblock polystyrene-b-polyisoprene copolymers by combining anionic polymerization and	20.06.2011	European Polymer Federation 2011, XII GEP Congress, June 26 - July 1, 2011, Granada, Spain	Scientific community (higher education, Research)		15
9	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Brillouin Light Scattering and Phonon Propagation in Mesoscopic Soft Materials	20.03.2012	XIII International Workshop on Complex Systems, Andalo, 18-22 March 2012	Scientific community (higher education, Research)		5
10	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Osmotic interactions and solid-liquid transitions in soft colloid-polymer mixtures	06.11.2011	4th workshop on Viscoplastic fluids: from theory to applicationRio de Janeiro, Brazil, Nov. 6-10	Scientific community (higher education, Research)		7

11	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Unique Slow Dynamics and Aging Phenomena in Soft Glassy Suspensions of Multiarm Star Polymers	10.10.2011	83rd Annual Meeting of the Society of Rheology, Cleveland, OH, USA, October 10-14, 2011	Scientific community (higher education, Research)		10
12	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Tunable Soft Colloids	13.06.2011	1st Summer Symposium on Nanomaterials and their Application to Biology and Medicine, Uni Poznan	Scientific community (higher education, Research)		4
13	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Polymeric hydrogels layers	13.06.2011	1st Symposium on Nanomaterials and their Application to Biology and Medicine, Poznan Univ	Scientific community (higher education, Research)		5
14	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Rotational Near Wall Brownian Dynamics: A TIRM and EWDLS Study	17.11.2011	Jülich Soft Matter days; Bonn, Germany	Scientific community (higher education, Research)	100	20
15	Oral presentation to a scientific event	UNIVERSITEIT ANTWERPEN	Advanced Tomography for Advanced Materials	01.06.2012	ESMI/SoftComp Annual meeting, Heraklion, Greece	Scientific community (higher education, Research) - Industry	50	20
16	Oral presentation to a scientific event	UNIVERSITEIT ANTWERPEN	Advanced Transmission Electron Microscopy: From 2D to 3D, For Hard and Soft Materials	18.05.2011	SoftComp Annual meeting, Heraklion, Greece	Scientific community (higher education, Research) - Industry	50	20

17	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	About the dynamic consequences of missing chain ends: A Mw-dependent case study of cyclic polyethyle	29.05.2012	ESMI/SoftComp Annual meeting, Heraklion, Greece	Scientific community (higher education, Research) - Industry	100	25
18	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Nanoparticles in materials and life sciences	18.05.2011	SoftComp Annual meeting, Heraklion, Greece	Scientific community (higher education, Research) - Industry	100	25
19	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Nanoparticles in materials and life sciences	15.06.2011	Nano Symposium in Poznan, Poznan, Poland	Scientific community (higher education, Research)		5
20	Posters	UNIVERSITEIT ANTWERPEN	Dark-Field imaging using an annular aperture	15.11.2011	Julich Soft Matter Days 2011, 15-18 november, Bonn, Germany	Scientific community (higher education, Research)	200	30
21	Posters	FORSCHUNGSZENTRUM JUELICH GMBH	Structure and Dynamics of Polyethylene Glycol Polymer Rings	26.03.2012	DPG-Frühjahrstagung, Berlin, 25 - 30 March 2012	Scientific community (higher education, Research)	1200	20
22	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	A sequence of physical processes determined and quantified in LAOS	07.08.2012	XVIth International Congree on Rheology in Lisbon, Portugal	Scientific community (higher education, Research)	1000	50
23	Oral presentation to a scientific event	KATHOLIEKE UNIVERSITEIT LEUVEN	Interfacial rheology	10.05.2011	7th Annual European Rheology Conference, Suzdal - Russia	Scientific community (higher education, Research)		25

24	Presentations	KATHOLIEKE UNIVERSITEIT LEUVEN	Assembling non-spherical particles at fluid-fluid interfaces	28.03.2012	Rideal Lecture: Gonville and Caius College, Cambridge, UK	Scientific community (higher education, Research)	30	2
25	Oral presentation to a scientific event	KATHOLIEKE UNIVERSITEIT LEUVEN	Rheology of particle-stabilized interfaces	26.09.2011	Dynamics of Complex Fluid-Fluid Interfaces	Scientific community (higher education, Research)	50	5
26	Oral presentation to a scientific event	KATHOLIEKE UNIVERSITEIT LEUVEN	Novel approaches to interfacial dilatational rheology	10.10.2011	Society of Rheology-Annual Meeting 2011, Cleveland, Ohio, USA,	Scientific community (higher education, Research) - Industry		25
27	Oral presentation to a scientific event	KATHOLIEKE UNIVERSITEIT LEUVEN	Spring-Plate Resonator Sensor for Measuring Viscosity of Small Amounts of Complex Fluids	07.06.2011	SENSOR 2011, Nuremberg, Germany	Scientific community (higher education, Research) - Industry		10
28	Oral presentation to a scientific event	BIOLIN SCIENTIFIC OY	High surface pressure Langmuir isotherms of pulmonary surfactants	12.07.2012	14th ICOMF (International Conference on Organized Molecular Films), Paris, France	Scientific community (higher education, Research)	500	30
29	Oral presentation to a scientific event	UNIVERSIDAD DE VIGO	Growth and Directional Assembly of Anisotropic Gold Nanoparticles	09.05.2011	1st International Colloids and materials Symposium	Scientific community (higher education, Research)		10
30	Oral presentation to a scientific event	UNIVERSIDAD DE VIGO	Synthesis Assembly and Applications of Plasmonic Metal	27.06.2011	IV School on Organometallic Chemistry Santiago de Compostela	Scientific community (higher education, Research)		15

			Nanoparticles		(Spain)			
31	Oral presentation to a scientific event	UNIVERSIDAD DE VIGO	Synthesis and Assembly of Metal Nanoparticles for SERS Detection and Labeling	07.02.2012	University of Bern (Switzerland)	Scientific community (higher education, Research)		1
32	Oral presentation to a scientific event	UNIVERSIDAD DE VIGO	Nanochemistry for Nanotechnology	01.06.2011	Minilubes Scientific Fellow's Congress Vigo (Spain)	Scientific community (higher education, Research)		10
33	Oral presentation to a scientific event	UNIVERSIDAD DE VIGO	Colloidal nanoplasmonics from the building blocks to sensing devices	24.08.2012	ACS Fall National Meeting 2012, Philadelphia, Pennsylvania (USA	Scientific community (higher education, Research)		25
34	Oral presentation to a scientific event	UNIVERSIDAD DE VIGO	Multifunctional Composite Colloidal Microgels	31.01.2011	Australian Colloid and Interface Society Meeting	Scientific community (higher education, Research)	100	15
35	Oral presentation to a scientific event	UNIVERSIDAD DE VIGO	Responsive Microgel Composite Colloids for Plasmonic Sensing	11.07.2011	Particles 2011- Stimuli Responsive Particles and Particle Assemblies Berlin	Scientific community (higher education, Research)		10

36	Oral presentation to a scientific event	UNIVERSIDAD DE VIGO	Smart Composite Nanoparticles for Capture, Detection and Release	24.04.2012	Areces International Symposium on "Drugs, Nanomedicine and Biomaterials : A common goal"	Scientific community (higher education, Research)		10
37	Oral presentation to a scientific event	LUNDS UNIVERSITET	Directing the Growth and Structure of Metal Nanocrystals	24.08.2012	ACS Fall National Meeting 2012, Philadelphia, Pennsylvania (USA)	Scientific community (higher education, Research)		50
38	Presentations	LUNDS UNIVERSITET	Assembling responsive nanoparticles	23.07.2012	Association in Solution III Bifröst; University, Iceland	Scientific community (higher education, Research)		12
39	Oral presentation to a scientific event	LUNDS UNIVERSITET	Protein interactions, stability and phase behavior insight from neutron and x-ray scattering exper	30.07.2012	Biological & Pharmaceutical Complex Fluids; Tomar Portugal	Scientific community (higher education, Research)		25
40	Oral presentation to a scientific event	LUNDS UNIVERSITET	Analytics, Physico-chemical Characterization, and Scattering Methods	31.10.2012	Swiss National Science Foundation Centre Löwenberg, Switzerland	Scientific community (higher education, Research) - Industry		5
41	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Dynamics on the Mesoscopic Scale - Structuring under Non-equilibrium Conditions	20.09.2012	19th Ostwald Kolloquium, Berlin, Germany	Scientific community (higher education, Research)		10

42	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Non-equilibrium relaxation and tumbling dynamics of polymers in shear flow	05.08.2012	XVIth International Congress on Rheology, Lissabon, Portugal	Scientific community (higher education, Research)		30
43	Posters	FORSCHUNGSZENTRUM JUELICH GMBH	Dynamic consequences of missing chain ends in cyclic polyethylene glycol	24.09.2012	Deutsche Neutronenstreutagung 2012 Bonn, Germany	Scientific community (higher education, Research)		5
44	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	About the dynamic consequences of missing chain ends: A molecular weight dependent case study of cyc	13.11.2012	Jülich Soft Matter Days 2012; Bad Honnef, Germany	Scientific community (higher education, Research)		20
45	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Structure and Dynamics of Monodisperse Ring Polymer	05.08.2012	XVIth International Congress on Rheology Lisbon, Portugal	Scientific community (higher education, Research)		30
46	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Some aspects of the polymer rings dynamics studied by a combination of pulsed field gradient (PFG) N	17.09.2012	GDCh FGMR 34th Annual Discussion Meeting ,Halle, Germany	Scientific community (higher education, Research)		10

47	Organisation of Workshops	FORSCHUNGSZENTRUM JUELICH GMBH	Topology and dynamics in cyclic polymers: A PEG case study S. Gooßen	08.10.2012	"Trends and Perspectives in Neutron Scattering for Soft Matter and Biophysics" Tutzing, Germany	Scientific community (higher education, Research)		10
48	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Microscopic Understanding of Cyclic Polymers	12.12.2012	Dynacop International Conference; Leed UK	Scientific community (higher education, Research)		15
49	Posters	UNIVERSIDAD DEL PAIS VASCO EHU UPV	Study of the dynamic heterogeneity in poly(ethylene-ran-vinyl acetate) co-polymer using nano-Dielect	03.09.2012	7th CONFERENCE ON BROADBAND DIELECTRIC SPECTROSCOPY, Leipzig, Gremany	Scientific community (higher education, Research)		15
50	Posters	UNIVERSIDAD DEL PAIS VASCO EHU UPV	Some considerations on Local Dielectric Spectroscopy	03.09.2012	7th CONFERENCE ON BROADBAND DIELECTRIC SPECTROSCOPY, Leipzig, Germany	Scientific community (higher education, Research)		15
51	Posters	UNIVERSIDAD DEL PAIS VASCO EHU UPV	Interface dielectric response in silica filled rubber compounds using standard- and nano-dielectric	03.09.2012	7th CONFERENCE ON BROADBAND DIELECTRIC SPECTROSCOPY, Leipzig, Germany	Industry		15

52	Posters	UNIVERSIDAD DEL PAIS VASCO EHU UPV	Some considerations on Local Dielectric Spectroscopy: Imaging and spectral adquisition	15.10.2012	MULTIFREQUENCY AFM CONFERENCE, MADRID; SPAIN	Scientific community (higher education, Research)		15
53	Oral presentation to a scientific event	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	Multifunctional Composite Colloidal Microgels for Catalysis and Detection	29.01.2013	Delft (The Netherlands)	Scientific community (higher education, Research)		EU
54	Oral presentation to a scientific event	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	Directed assembly of plasmonic nanoparticles	20.02.2013	Barcelona	Scientific community (higher education, Research)		EU
55	Oral presentation to a scientific event	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	Directing the Morphology and Assembly of Gold Nanoparticles	07.04.2013	New Orleans	Scientific community (higher education, Research)		Worldwide
56	Oral presentation to a scientific event	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	Using Polymers to Direct the Growth and Assembly of Gold Nanoparticles	21.05.2013	Sitges	Scientific community (higher education, Research)		EU

57	Oral presentation to a scientific event	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	Engineering Metal Nanoparticles for Plasmonic Sensing	29.08.2013	San Sebastián	Scientific community (higher education, Research)		EU
58	Oral presentation to a scientific event	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	Directional Growth and Assembly of Plasmonic Colloids	03.09.2013	Sofia	Scientific community (higher education, Research)		worlwide
59	Oral presentation to a scientific event	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	Morphological Evolution and Optical Changes During Seeded Growth of Metallic and Bimetallic Colloids	23.09.2013	Paderborn	Scientific community (higher education, Research)		EU
60	Oral presentation to a scientific event	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	116. Colloidal Metal Nanoparticles. Synthesis and Sensing Applications	30.09.2013	Madrid	Scientific community (higher education, Research)		EU
61	Oral presentation to a scientific event	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	Anisotropy in nanoparticles. Anisometric and Janus particles	27.10.2013	Cuenca (Spain)	Scientific community (higher education, Research)		EU

62	Oral presentation to a scientific event	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	Engineering Metal Nanoparticles for Plasmonic Sensing	02.12.2013	Toulouse (Francia)	Scientific community (higher education, Research)		EU
63	Organisation of Conference	ASOCIACION CENTRO DE INVESTIGACION COOPERATIVA EN BIOMATERIALES- CIC biomaGUNE	15th Iberian Meeting on Colloids and Interfaces	26.06.2013	San Sebastián	Scientific community (higher education, Research)		Spain, Portugal
64	Organisation of Workshops	UNIVERSITEIT ANTWERPEN	EMAT Workshop on Transmission Electron Microscopy	10.06.2013	Antwerp	Scientific community (higher education, Research) - Industry		15 different countries
65	TV clips	UNIVERSITEIT ANTWERPEN	Behind The Science-National Geographic	04.04.2013	Antwerp	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		Belgium-The Netherlands
66	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Non-equilibrium relaxation and tumbling dynamics of polymers in shear flow	05.08.2012	Lisbon (Portugal)	Scientific community (higher education, Research)	100	20
67	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Non-Equilibrium Dynamics of Linear and Star Polymers in Solution	21.09.2012	Berlin (Germany)	Scientific community (higher education, Research)	100	10

68	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Mesoscale hydrodynamics simulations of soft and active matter	17.10.2012	Singapore (Singapore)	Scientific community (higher education, Research)	75	10
69	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Dynamics of active particles in microchannel flows	04.04.2013	Leuven (Belgium)	Scientific community (higher education, Research)	50	8
70	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Hydrodynamic correlations: Backtracking of colloids and polymers	30.05.2013	Rimini (Italy)	Scientific community (higher education, Research)	50	10
71	Posters	FORSCHUNGSZENTRUM JUELICH GMBH	End-functionalized semiflexible polymer suspensions at equilibrium and under shear flow	18.09.2013	Rome (Italy)	Scientific community (higher education, Research)	50	30

72	Oral presentation to a scientific event	UNIVERSIDAD DEL PAIS VASCO EHU UPV	Monitoring the segmental relaxation time of PVAc in nanocomposites with silica in the physical aging regime (Oral) D. Cangialosi Probing Locally Molecular Dynamics: Imaging and Nanodielectric Spectroscopy	29.05.2013	RIMINI (ITALY)	Scientific community (higher education, Research) - Industry	50	10
73	Posters	UNIVERSIDAD DEL PAIS VASCO EHU UPV	A simple model for NanoDielectric Spectroscopy	22.07.2013	BARCELONA (SPAIN)	Scientific community (higher education, Research)	100	20
74	Posters	UNIVERSIDAD DEL PAIS VASCO EHU UPV	Multiphase Modeling of the Dielectric Relaxation in poly (ethylene-ran- vinyl acetate) Copolymers	17.09.2013	ROME (ITALY)	Scientific community (higher education, Research)	100	30
75	Oral presentation to a scientific event	UNIVERSITY OF LEEDS	The Trouble with hot Brownian motion and stochastic thermodynamics	08.03.2013	"Stochastic Thermodynamics", Nordita, Stockholm, Sweded	Scientific community (higher education, Research)	55	13
76	Oral presentation to a scientific event	UNIVERSITY OF LEEDS	Inherent non-locality in inhomogeneous diffusion	30.05.2013	Annual SoftComp and ESMI meeting, Rimini (Italy)	Scientific community (higher education, Research)	50	20

77	Organisation of Conference	UNIVERSITY OF LEEDS	Mathematical Modelling and Analysis of Complex Fluids and Active Media - Conference	19.08.2013	Leeds, UK	Scientific community (higher education, Research)	35	9
78	Organisation of Workshops	UNIVERSITY OF LEEDS	Mathematical Modelling and Analysis of Complex Fluids and Active Media in Evolving Domains	01.05.2013	Workshop at Isaac Newton Institute, Cambridge, 1 May - 23 August 2013	Scientific community (higher education, Research) - Industry	70	20
79	Oral presentation to a wider public	UNIWERSYTET IM. ADAMA MICKIEWICZA W POZNANIU	Researchers Night: Nano	27.09.2013	Faculty of Physics Adam Mickiewicz University in Poznan, Poland	Scientific community (higher education, Research) - Civil society	250	1
80	Oral presentation to a scientific event	UNIVERSIDAD DEL PAIS VASCO EHU UPV	Atomic and molecular probe characterization of poly(isoprene)s by PALS and ESR in relation to broadband dielectric spectroscopy	03.09.2012	7th CONFERENCE ON BROADBAND DIELECTRIC SPECTROSCOPY, Leipzig, Gremany	Scientific community (higher education, Research)		15
81	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Correlation of Structure and Dynamics in Monodisperse Ring Polymers	27.05.2013	SoftComp Annual Meeting, Rimini, Italy	Scientific community (higher education, Research) - Industry	150	20

82	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Dynamic consequences of missing chain ends	23.07.2013	7th. International Discussion Meeting on Relaxation in Complex Systems, Barcelona, Spain	Scientific community (higher education, Research)	120	15
83	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Polymer, Rings and Pores: a Neutron Scattering Study	11.03.2013	DPG Spring Meeting of the Condensed Matter Section, Regensburg, Germany	Scientific community (higher education, Research)	300	10
84	Oral presentation to a scientific event	UNIVERSITY OF LEEDS	SPH method for complex fluids	21.08.2013	Workshop: "Mathematical Modelling and Analysis of Complex Fluids and Active Media ... " Leeds, UK	Scientific community (higher education, Research)	50	3
85	Oral presentation to a scientific event	LUNDS UNIVERSITET	Light Scattering Applications: Turbid and Strongly Interacting Suspensions	12.05.2013	International Workshop on Modern Light Scattering Technologies Leeds, England	Scientific community (higher education, Research) - Industry	20	UK, Italy, Germany, France, Switzerland
86	Oral presentation to a scientific event	LUNDS UNIVERSITET	Concentrated protein solutions, or a physicists view of cataract formation	13.05.2013	Soft Matter Physics Seminar, University of Leeds - Leeds, England	Scientific community (higher education, Research)	30	UK
87	Oral presentation to a scientific event	LUNDS UNIVERSITET	Characterizing and understanding concentrated suspensions	02.07.2013	Formula VII International Workshop - Mulhouse, France	Scientific community (higher education, Research) - Industry	100	20

88	Oral presentation to a scientific event	LUNDS UNIVERSITET	Characterizing and understanding complex fluids - utilizing the European Soft Matter Infrastructure ESMI	31.10.2013	BASF, Ludwigshafen, Germany	Industry	30	1
89	Oral presentation to a scientific event	LUNDS UNIVERSITET	Assembling responsive nanoparticles: From model atoms to smart materials	03.12.2013	Society of Chemistry and Physics Vienna (CPG) - Vienna, Austria	Scientific community (higher education, Research)	40	1
90	Oral presentation to a scientific event	UNIVERSITEIT TWENTE	RaPiD: A coarse grained algorithm for the simulation of polymer dynamics	12.06.2013	MSSi Research Forum, University of Limerick, Ireland	Scientific community (higher education, Research)	30	Ireland
91	Oral presentation to a scientific event	UNIVERSITEIT TWENTE	Simulation of Star Polymer Dynamics using RaPiD	29.05.2013	ESMI Annual Meeting, Rimini, Italy	Scientific community (higher education, Research)	60	EU
92	Oral presentation to a scientific event	UNIVERSITEIT TWENTE	Coarse Grained Simulations of Star Polymer Melts	08.03.2013	Dutch Molecular Dynamics (DMD) Day, Eindhoven, the Netherlands	Scientific community (higher education, Research)	80	3
93	Oral presentation to a scientific event	UNIVERSITEIT TWENTE	Coarse Grained Simulations with RaPiD of Star Polymer Melts	04.03.2013	Study Group Meeting Physics and Materials, Veldhoven, the Netherlands	Scientific community (higher education, Research)	80	1

94	Oral presentation to a scientific event	UNIVERSITEIT TWENTE	Coarse Grained Simulations of Star Polymer Suspensions	08.11.2012	13th Soft Matter Meeting, Wageningen, the Netherlands	Scientific community (higher education, Research)	100	3
95	Posters	UNIVERSITEIT TWENTE	Coarse Grained Simulations of Star Polymer Melts	03.04.2013	8th Annual European Rheology Conference (AERC), Leuven, Belgium	Scientific community (higher education, Research)		EU
96	Oral presentation to a scientific event	UNIVERSITEIT TWENTE	Flow-induced alignment in shear-thinning viscoelastic fluids	08.08.2012	XVIth International Conference on Rheology, Lisbon, Portugal	Scientific community (higher education, Research)		Worldwide
97	Posters	UNIVERSITEIT TWENTE	Flow-induced alignment in shear-thinning viscoelastic fluids	03.04.2013	8th Annual European Rheology Conference (AERC), Leuven, Belgium	Scientific community (higher education, Research)		EU
98	Posters	UNIVERSITEIT TWENTE	Influence of microscopic ordering on the rheology of complex fluids	18.09.2013	International Soft Matter Conference 2013, Rome, Italy	Scientific community (higher education, Research)		Worldwide
99	Oral presentation to a scientific event	UNIVERSITEIT TWENTE	Responsive Particle Dynamics (RaPiD): A method for the simulation of soft matter at the mesoscopic level	08.03.2013	Dutch Molecular Dynamics (DMD) Day, Eindhoven, the Netherlands	Scientific community (higher education, Research)	80	3
100	Posters	UNIVERSITEIT TWENTE	Coarse grained model for polymer	15.11.2012	Julich Soft Matter Days 2012, Bad Honnef,	Scientific community (higher education,		EU

			droplets using RaPiD		Germany	Research)		
101	Oral presentation to a scientific event	UNIVERSITEIT TWENTE	Modeling surface tension and polymer-wall interactions using RaPiD	08.11.2012	13th Soft Matter Meeting, Wageningen, the Netherlands	Scientific community (higher education, Research)	100	3
102	Oral presentation to a scientific event	UNIVERSITEIT TWENTE	Statistical Models of Fracture inspired in the drying of the bamboo Guadua Angustifolia	23.03.2012	Dutch Molecular Dynamics (DMD) Day, Groningen, the Netherlands	Scientific community (higher education, Research)	80	3
103	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Ultrasmall Biocompatible Nanocomposites	30.05.2013	ESMI Annual Meeting, Rimini (Italy)	Scientific community (higher education, Research)	50	15
104	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Self Assembly of Nanoparticles	30.03.2013	The German Liquid Crystal Conference, Hamburg	Scientific community (higher education, Research)		5
105	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Synthesis and Self Assembly of Semiconducting and Magnetic Nanoparticles	09.05.2011	E-MRS, Nice	Scientific community (higher education, Research)		20
106	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Particle Development and Characterization	29.06.2011	Vibrant Meeting, Brussels	Scientific community (higher education, Research)		10

107	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Nanoparticles for Materials- and Life Sciences	21.09.2011	Nanocon, Brno	Scientific community (higher education, Research)		15
108	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Nanoparticles for Materials- and Life Sciences	08.03.2012	PIER Colloquium, Hamburg	Scientific community (higher education, Research)		10
109	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Functionalized nanocluster materials: precise synthesis and selected applications	20.06.2012	Julius-Springer-Prize Lecture, Berlin	Scientific community (higher education, Research)		5
110	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Synthesis and Self-Assembly of Nanoparticles into Functional Materials for Energy and Medical Applications	10.07.2012	ONSNO, Dresden	Scientific community (higher education, Research)		10
111	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Precision Synthesis of Nanoparticles and Their Use in Biomedical Applications	22.08.2012	244th ACS National Meeting, Philadelphia	Scientific community (higher education, Research)		30
112	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	How to dressnanoparticles for biological and medical applications	01.11.2012	SPP 1313 Summerschool, Tutzing	Scientific community (higher education, Research)		5

113	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Nanoteilchen aus der Flasche - Perspektiven für neue Materialien	25.09.2013	DPG Berlin Vortragsreihe, Berlin	Scientific community (higher education, Research) - Civil society		1
114	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Controlling the Biological Response to Nanoparticles by Surface Chemistry	03.03.2014	SPP1313 Colloquium, Fulda	Scientific community (higher education, Research)		5
115	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Precision Synthesis of Size and Shape Controlled Nanocrystals for Applications in Materials and Life Sciences	02.04.2014	SPP1415 Workshop, Goslar	Scientific community (higher education, Research)		5
116	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Precision Synthesis of Size and Shape Controlled Nanocrystals for Applications in Materials and Life Sciences	08.04.2014	Zsigmondy Colloquium, Konstanz	Scientific community (higher education, Research)		5
117	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Precision Synthesis of Nanocrystals and Their Use in Biomedical Applications	06.05.2014	30 Years of Colloidal Quantum Dots, Paris	Scientific community (higher education, Research)		25

118	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Fluorescent and Magnetic Nanocrystals for Materials and Life Sciences	09.09.2014	International Conference of Fundamental Processes in Semiconductor Nanocrystals, Oxford	Scientific community (higher education, Research)		30
119	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Nanoparticles for Bioimaging	11.02.2015	Winter School on -Hirachically Nanostructured Materials", Les Diablerets	Scientific community (higher education, Research)		5
120	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Synthesis and Surface Functionalization of Nanocrystals for Biomedical Applications	01.07.2015	ICMAT, Singapore	Scientific community (higher education, Research)		40
121	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Quantum Dots: Technologie und Biomedizinische Anwendungen	29.10.2015	Workshop: Nano- und Mikropartikel für die biomedizinische Analytik, Golm	Scientific community (higher education, Research) - Industry		5
122	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Synthesis, Properties and Applications of Nanocrystals in Materials and Life Sciences	18.11.2015	International Conference on Applied Chemistry, Jeddah	Scientific community (higher education, Research)		20
123	Oral presentation to a scientific event	UNIVERSITAET HAMBURG	Nanocrystals for Energy and Biomedical	30.05.2014	Bunsentagung, Hamburg	Scientific community (higher education, Research)	200	5

			Applications					
124	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Orthogonal superposition rheometry of colloidal glasses	09.10.2014	Society of Rheology 86th Annual Meeting, Philadelphia, Pennsylvania, USA	Scientific community (higher education, Research)	50	worldwide
125	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Searching for model nonlinear polymers: Architectural disparity and viscoelasticity	22.07.2014	6th Pacific Rim Conference on Rheology, Melbourne, Australia, July 20-25, 2014.	Scientific community (higher education, Research)	100	Pacific countries
126	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Rheology, structure and dynamics of hard sphere glasses during start-up and shear cessation	10.04.2014	Annual European Society of Rheology Meeting, 8-11 April 2014, Karlsruhe, Germany	Scientific community (higher education, Research)	50	Europe wide
127	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Flow of colloidal glasses and gels: From microscopic structure and dynamics to rheology	05.12.2014	10th Hellenic Polymer Society Conference, 4-6 December 2014, Patras, Greece,	Scientific community (higher education, Research)	80	Greece
128	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Residual Stresses in colloidal gels	16.04.2015	Annual European Society of Rheology Meeting, 14-17 April 2015, Nantes, France	Scientific community (higher education, Research)	50	Europe wide

129	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Structure and Dynamics in Sheared Colloidal Glasses	01.06.2015	SoftComp Topical Workshop Dense Suspensions Flow, Edinburgh, 1-3 June 2015	Scientific community (higher education, Research)	50	Europe wide
130	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Convective Cage Release in Model Colloidal Glasses	12.10.2015	Society of Rheology 87th Annual Meeting, 11-15 October 2015, Baltimore, Maryland, USA	Scientific community (higher education, Research)	100	world wide
131	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Viscoelastic properties of critically purified cyclic polymers over a wide range of molecular weights	08.04.2013	ACS National Meeting & Exposition, New Orleans, LA, USA, April 7-11, 2013.	Scientific community (higher education, Research)	100	worldwide
132	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Stress overshoots in simple shear flow of entangled combs	13.10.2013	85rd Annual Meeting of the Society of Rheology, Montréal, Québec, Canada, October 13-17, 2013	Scientific community (higher education, Research)	80	worldwide
133	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Metastability and arrested phase separation in asymmetric mixtures of soft and hard colloids	06.10.2014	86th Annual Meeting of the Society of Rheology, Philadelphia, PA, October 5-9, 2014.	Scientific community (higher education, Research)	90	worldwide

134	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Interpenetration, entanglements and bonding interactions in dendronized polymers	12.10.2015	87th Annual Meeting of the Society of Rheology, Baltimore, MD, October 11-15, 2015.	Scientific community (higher education, Research)	90	worldwide
135	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Metastable states and rheological transitions in soft colloids	16.10.2013	Society of Rheology Japan (SRJ), Kyoto, Japan, May 16-17, 2013	Scientific community (higher education, Research)	100	Asia
136	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Dynamics in mixtures of architecturally complex entangled homopolymers	22.07.2013	7th International Discussion Meeting on Relaxations in Complex Systems, Barcelona, Spain, July 21-26	Scientific community (higher education, Research)	50	Europe wide
137	Oral presentation to a wider public	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Entanglement dynamics and architectural dispersity in model nonlinear polymers	14.07.2014	Gordon Polymer Physics Conference, Mount Holyoke College, South Hadley, MA, July 13-18, 2014.	Scientific community (higher education, Research)	50	worldwide
138	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Model entangled branched polymers in shear and extension	10.12.2014	European Science & Engineering Programme (ESPEP), 25th Birthday Symposium, ExxonMobil Chemical Europ	Scientific community (higher education, Research) - Industry	50	Europe wide
139	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Regular highly branched polymers: from polymeric to colloidal properties	24.03.2015	249th ACS National Meeting, Denver, CO, USA, March 23-25, 2015	Scientific community (higher education, Research)	150	Worldwide

140	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	Outstanding challenges in entanglement dynamics: beyond the classic picture	14.10.2015	AERC2015, Nantes, France, April 14-17, 2015.	Scientific community (higher education, Research) - Industry	500	Europe wide
141	Oral presentation to a scientific event	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	The unusual rheology of cyclic polymers and their mixtures	20.04.2015	7th International Symposium on Engineering Plastics, Xining, China, August 18 21, 2015	Scientific community (higher education, Research)	120	China and Asia
142	Oral presentation to a scientific event	UNIVERSITY OF LEEDS	Smoothed particle hydrodynamics of complex fluids	02.04.2014	Annual Meeting of the German Physical Society, Dresden 2014	Scientific community (higher education, Research) - Industry	500	25
143	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Dynamics of active particles in microchannel flow	30.04.2014	Workshop "Soft Matter at Interfaces 2014", Ringberg Castle, Germany	Scientific community (higher education, Research)	50	07. Okt
144	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Hydrodynamics of Driven and Active Matter	16.12.2014	Workshop 'Flowing Matter 2014' of EU- COST Program 'Flowing Matter'; Lisbon Portugal	Scientific community (higher education, Research)	200	15-20
145	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Nonequilibrium properties of sheets under shear flow	15.04.2015	10th Annual European Rheology Conference, Nantes, France	Scientific community (higher education, Research)	250	Okt 20

146	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Attractive end-functionalized semiflexible polymer suspensions at equilibrium and under shear flow	15.04.2015	10th Annual European Rheology Conference, Nantes, France	Scientific community (higher education, Research)	250	Okt 20
147	Oral presentation to a scientific event	MALVERN INSTRUMENTS LTD	Self-organization of end-functionalized semiflexible polymer suspensions under shear flow	11.06.2015	ESMI/SoftComp Annual Meeting, Ancona, Italy	Scientific community (higher education, Research) - Industry	150	15-20
148	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Self-organization of end-functionalized semiflexible polymer suspensions at equilibrium and under shear flow	13.10.2015	The Society of Rheology 87th Annual meeting, Baltimore, USA	Scientific community (higher education, Research) - Industry	500	40-50
149	Oral presentation to a scientific event	FORSCHUNGSZENTRUM JUELICH GMBH	Nonequilibrium properties of sheets under shear flow	14.10.2015	The Society of Rheology 87th Annual meeting, Baltimore, USA	Scientific community (higher education, Research) - Industry	500	40-50
150	Posters	FORSCHUNGSZENTRUM JUELICH GMBH	Self-organization of end-functionalized semiflexible polymer suspensions under flow	12.11.2014	Jülich Soft Matter Days, Bad Honnef, Germany	Scientific community (higher education, Research)	180	Okt 15

Section B Exploitation of foreground (confidential)

In a few cases, the ESMI joint research activities led to foreground which has the potential for commercial exploitation. The resulting methods or products are targeted at the scientific soft matter community.

ESMI partners CICbiomaGUNE and the University of Hamburg are collaborating with the Center for Applied Nanotechnology (CAN GmbH) in Hamburg, on the implementation of a flow reactor for specialized purposes in the synthesis of colloidal assemblies. Negotiations on a joint exploitation agreement and an IPR agreement are currently in progress.

ESMI partners LS-Instruments and the University of Lund developed novel light scattering instrumentation, which will be commercially available in the near future. Market release of the device is previewed for 2016.

Partners Forschungszentrum Jülich and FORTH jointly developed a method for near-wall laser doppler velocimetry, for which the European patent No.: 2259076 was issued in December 2014. Options for commercialization will be jointly explored.

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TEMPLATE B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC					
Type of IP Rights	**Confidential**	**Foreseen embargo date dd/mm/yyyy**	**Application reference(s) (e.g. EP123456)**	**Subject or title of application**	**Applicant(s) (as on the application)**
Patents	No		EP2259076	Method for determining the speed of particles dispersed in a flowing solution	Forschungszentrum Jülich GmbH

Part B2

Type of Exploitable Foreground	Description of Exploitable Foreground	Confidential	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable for commercial use or any other use	Patents or other IPR exploitation (licences)	Owner and Other Beneficiary(s) involved
Commercial exploitation of R&D results	A NEW FLOW REACTOR FOR REPRODUCIBLE NANOPARTICLE SYNTHESIS	Yes	01.10.2016	1. SYNTHESIS EQUIPMENT 2NANOPARTICLES	1. MEDICAL 2. OPTICS 3. SENSORS	2018	under negotiation	CIC biomaGUNE / University of Hamburg /Center for Applied Nanotechnology (CAN GmbH)Hamburg
Commercial exploitation of R&D results	A new Instrument for Dynamic and static Light scattering at ultra low angles	Yes	31.12.2016	USALS instrument	Soft matter research	2016	not applied, too expensive and offered protection not efficient	LS-Instruments and University of Lund