Two-dimensional colloidal nanostructures - Synthesis and electrical transport

Fact Sheet

<table>
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<th>Project Information</th>
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<tr>
<td>2D–SYNETRA</td>
<td>Funded under FP7-IDEAS-ERC</td>
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<tr>
<td>Grant agreement ID: 304980</td>
<td>Overall budget € 1 497 200</td>
</tr>
<tr>
<td>Status</td>
<td>EU contribution € 1 497 200</td>
</tr>
<tr>
<td>Closed project</td>
<td>Hosted by UNIVERSITAET HAMBURG Germany</td>
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<tr>
<td>Start date 1 February 2013</td>
<td>End date 31 January 2019</td>
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Objective

We propose to develop truly two-dimensional continuous materials and two-dimensional monolayer films composed of individual nanocrystals by the comparatively fast, inexpensive, and scalable colloidal synthesis method. The materials’ properties will be studied in detail, especially regarding their (photo-)electrical transport. This will allow developing new types of device structures, such as Coulomb blockade and field enhancement based transistors.

Recently, we demonstrated the possibility to synthesize in a controlled manner truly two-dimensional colloidal nanostructures. We will investigate their formation mechanism, synthesize further materials as “nanosheets”, develop methodologies to tune their geometrical properties, and study their (photo-)electrical properties.

Furthermore, we will use the Langmuir-Blodgett method to deposit highly ordered monolayers of monodisperse nanoparticles. Such structures show interesting...
Monolayers of monodisperse nanoparticles. Such structures show interesting transport properties governed by Coulomb blockade effects known from individual nanoparticles. This leads to semiconductor-like behavior in metal nanoparticle films. The understanding of the electric transport in such “multi-tunnel devices” is still very limited. Thus, we will investigate this concept in detail and take it to its limits. Beside improvement of quality and exchange of material we will tune the nanoparticles’ size and shape in order to gain a deeper understanding of the electrical properties of supercrystallographic assemblies. Furthermore, we will develop device concepts for diode and transistor structures which take into account the novel properties of the low-dimensional assemblies.

Nanosheets and monolayers of nanoparticles truly follow the principle of building devices by the bottom-up approach and allow electric transport measurements in a 2D regime. Highly ordered nanomaterial systems possess easy and reliably to manipulate electronic properties what make them interesting for future (inexpensive) electronic devices.

Field of science

/ engineering and technology / materials engineering / coating and films
/ humanities / arts / modern and contemporary art / film
/ engineering and technology / nanotechnology / nano-materials / nanocrystal
/ social sciences / social and economic geography / transport

Programme(s)

Topic(s)

Call for proposal

ERC-2012-StG_20111012

Funding Scheme

ERC-SG - ERC Starting Grant

Host institution

UNIVERSITAET HAMBURG
Beneficiaries (1)

UNIVERSITAET HAMBURG

Address
Mittelweg 177
20148 Hamburg
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EU contribution
€ 1 497 200

Activity type
Higher or Secondary Education Establishments

Website
Contact the organisation

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Last update: 2 August 2019
Record number: 106908

Permalink: https://cordis.europa.eu/project/id/304980/

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