Project no. 033211

GOLEM

Bio-inspired Assembly Process for Mesoscale Products and Systems

Instrument: SIXTH FRAMEWORK PROGRAMME

Thematic Priority: PRIORITY 3 / NMP

12 MONTHS ACTIVITY REPORT : EXECUTIVE SUMMARY

Period covered:	2007-02-28 /2007-09-21	Date of preparation:	2007-09-27
Start date of project:	**2006-09-01**	Project Duration:	**36 months**
Project coordinator name:	**Yves Bellouard**		
Project coordinator organisation name:	**TU Eindhoven**	Revision [draft, 1, 2, …]:	Revision 17 October 2008

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	**X**

1 Executive summary

The main objective of the project is to use an approach based on bio-inspired bonds to assemble parts at the micro- and nano- scales. The so-called grand challenge of the project is to assemble a thousand mesoscale parts of at least two different types, on the same substrate or together, using bio-inspired bonds.

This report ends the first year of GOLEM. Globally, the project is well on track and we have fulfilled most of our objectives and for some of them well beyond our initial expectations.

First bonds strength measurements have been successfully completed by the team involved in workpackage 1. Specific protocols have been developed and will be used to further functionalized mesoscale parts. So far, we have not yet succeeded in a full-surface attachment (i.e. a bonded area comparable to the size of meso-scale parts) but all the testing procedures and protocols are now in place for a testing campaign in the coming weeks. We expect important results on that front soon as we are currently behind schedule (we were initially planning to have first results at the end of the first year). This delay is mainly due to the difficulties to recruit appropriate personnel to work on this topic. This problem has been solved recently and the team working on this workpackage is now complete.

On the topic of bio-inspired polymers that could potentially be used as a substitute to biomolecules, we are proud to announce that the first molecules have been synthesized and that initial characterizations have been successfully conducted. In the coming weeks, the bonding strength of these molecules will be evaluated using tip-less cantilevers and other probes.

On the second workpackage which specifically addresses the collective manipulation of meso-scale parts and the design of the assembly chamber, the team has successfully developed a first prototype of assembly chamber that will be used to further explore the most suitable collective manipulation strategies to achieve the highest yield in mesoscale parts bio-attachments. In parallel, breakthrough investigations of laser-based micro-part steering have demonstrated the manipulation of “large scale” components. This is quite an accomplishment as so far; laser trapping has been limited to significantly smaller parts that the one we plan to use in this project.

The work done on the third workpackage – that focuses on the development of a test platform to characterized bio-inspired assembled mesoscale components – is also well on track. The platform design is nearly completed and the platform is being assembled and will be tested during the next reporting period.

On the fourth workpackage (aiming at implementing simulation tools for the assembly process), a set of simulation tools have been implemented to test the assembly process at various length scales. At the molecular level, attachment energy will be predicted using a simplified molecular binding force model. At the mesoscale, an open source software package is being used to test the collective behaviour of mesoscale parts submitted to various force fields.

Overall, the team is quite proud of the work accomplished so far. Much work remains to be done and we expect important results in the next six months as nearly all the tools required to test the Golem concept are progressively being implemented.