

4M Summer School

August 2007, Denmark

The 4M Network of Excellence held its first Summer School in 2007. Sixteen international students made the trip to IPL, at the Technical University of Denmark, during the two first weeks of August 2007, to work hard and learn about micro technologies.



They were treated to a **combination of lectures, practical work** and a whole-school project. **The lectures covered the following subjects: tooling technologies** (Micro cutting, Micro EDM, Laser ablation, Electrochemical deposition processes ...), **replication techniques adapted to micro scale** (Micro injection moulding, Micro metal forming...), **micro products functionalities** (Microfluidic devices, Micro products overview, Micro optical devices), **methodology of design** (Delta Design engineering role-playing experience, life cycle assessment, toolbox for design...), **metrology, micro handling and assembly** (Laser welding, Joining...). They were given by staff from DTU, with invited guest lecturers from other 4M partners (for a **ceramic processing overview and a sensors and actuators lecture**) as well as from the industry.

Regarding the project work, the student's task was the design and manufacturing of two fluidic mixing devices with a common optically-functional lid. The lecture on microfluidics gave ideas in terms of mixing principles based on geometry and it was decided to try them, albeit with different technologies. Indeed the examples were taken from the silicon

area whereas the course was focusing on non-silicon manufacturing processes. An innovative (and risky) process chain was chosen for the embedding of the optics in the lid: commercially available lenses were mounted on a master, rendered conductive through a PVD step and

electroplated in order to obtain an insert for injection moulding.

Not everything went according to plan, but the students were able to pursue the complete product development of their three parts: collaborative design, manufacturing of masters and inserts, injection moulding and joining. Though the devices were not functional, the learning objectives were achieved and potential solutions and/or improvements were identified.

The evaluation consisted of technical reports for each part (2 fluidic devices and 1 lid) which were presented in front of an examination board (DTU summerschool staff and an external censor from the 4M network). It should be added that the students produced a "paper-like" description of their PhD subject which was included in the material given to them (using the same format as the proceedings of the 4M conferences) that they handed-in before coming to the summerschool. They also held a 15 minute presentation about their work and their lab.

All in all it was a great experience. Everyone worked hard, learned a lot (both students and teachers alike) and had a very good time. Social activities were not forgotten and the team spirit was great. And it is important to

mention that Denmark was kind enough to deliver the good weather promised by the organisation staff, for at least half of the time!

The good news is that plans for a 4M Summer School are already underway so keep an eye out for details on the 4M website (www.4m-net.org) early in 2008.

4M 2007 Conference

Borovets, Bulgaria

Our third conference, 4M2007, attracted some 140 delegates to the stunning mountain resort of Borovets in Bulgaria. Six fascinating addresses were delivered by the invited speakers to an interested and knowledgeable audience. These were complemented by the papers selected for oral presentation in the thematic sessions. Meanwhile a well-presented poster session gave everyone further opportunity to network and discuss each other's work. Finally, a superb banquet dinner offered by our Bulgarian hosts gave all delegates an insight to the culture and music of the



country. The organising committee would like to take this opportunity to thank all those who made the event a success: the Samokov Hotel; Prof. Yuli Toshev and the team from BAS; Technical University Sofia; our sponsors; all attendees, authors and speakers; theme chairs and reviewers; the 4M Industrial Advisory Board; Whittles publishing; the 4M office in Cardiff; and last, but not least, Juliane Sandner from FZK.

4M2008 - Our fourth annual conference on multi-material micro manufacture, 4M2008, will be held in Cardiff, UK on 9th - 11th September 2008. The First Call for Papers is available now at:

<http://www.4m-net.org/conference>