

# Report on the Summerschool in Älvdalen, Sweden, 2006

## Polyphase and composite materials

The summerschool in Älvdalen was focused on bringing together a wide variety of researchers as speakers with Ph.D.-Students and postdocs from the various fields of Material Science, Mechanical Engineering and Geology to give of the different groups a sound understanding of the relevant other sciences. The format of this summerschool was chosen so that ample time was given for the participants to interact with each other and with the speakers. The overall atmosphere was very productive since most of the speakers were at the conference site during the scheduled free times (usually the afternoons) and were very willing to answer any questions put forth to them. This has lead to a lot of very interesting discussions between speakers and participants.

The first day of the conference gave each participant and most likely some of the speakers a very good overview about the different materials used in the different fields or research (rocks, biomaterials, polymers etc.) and gave a very good overview about material design in general. This day turned out to be invaluable for the further proceedings of the conference as it not only created a common understanding of the different fields of research for the participants but also clarified vocabulary used during the rest of the conference.

The second day was denoted to phase boundaries of different materials and processes acting on these phase boundaries. This included "regular" materials such as rocks but also multi-phase composites such as cement.

A field trip to the surrounding meteor crater was scheduled for the third day. Being a geologist myself I did not learn any new things but was able to use the time to talk more about different aspects of polyphase materials with the speakers of the summer school who also attended the field trip.

The fourth day had the analyzation, characterization and visualization of phase boundaries as a general topic. This included different techniques (such as atomic force microscopy and synchrotron measurements) and was of particular importance for my own project funded by the ESF. I will extensively work with the research Lab in Riso (Denmark) to perform different experiments at their beam line at the CERN in Grenoble and this summerschool was a very good opportunity to make contacts with one of their researchers. During several afternoons I was able to learn the most important facts about the actual experiment technique and available equipment at the Synchrotron and also, and equally important, learned about how to write an application for beam time and how the evaluation process of these applications works.

The fifth day of the summerschool continued with talks about the predication of mechanical properties of polyphase materials but was mainly devoted to a poster session with applications/current research of the participants.

The sixth day was occupied with talks on miscellaneous topics such as the materials used in medicinal applications, the fabric and usage of wood, self-assembled materials, nano-structures and the challenges in construction material research and industrial processing. This was very also very interesting since the methods used are the same as the ones used in geological research but the range of analyzations and the specific application of these techniques apparently is very different.

Most of the seventh day was devoted to career management in general, in the evenings interesting talks about numerical modeling in the different disciplines of material science were given that continued on the eighth day of the summerschool which concluded with a hands-on lab on

numerical modeling. I have included below a copy of the time table with the specific titles of the talks of the conference.

I would very much like to thank the ESF for giving me the opportunity to attend this conference. It was very interesting and because of the format in which it was held quite different (in a very positive way) from “regular” conferences. The time that the participants are able to spend talking to the presenters and among themselves was very well chosen. The talks usually lay the foundation for everybody and arising questions were discussed in most of the free time during the conference.

Dr. J.K. Becker

Abstract of the poster I presented:

Grain boundary migration is one of the most important processes that can change a microstructure under static conditions. The movement of grain boundaries depends on the grain boundary surface energy and mobility. If a liquid phase, like melt, is also present in the aggregate, an order of complexity is added, since above a certain melt fraction (and/or below a certain wetting angle) the melt pockets are interconnected by tubes or channels that allow rapid transport within or out of the aggregate. Under static conditions, i.e. crystallization and annealing, the melt has a defined wetting angle at triple junctions (where two solid grains are in contact with melt).

In dynamic conditions such as pure or simple shear of the microstructure, the evolution of the shape of melt pockets obviously is greatly influenced by the stresses acting on the microstructure. However, grain boundary migration and the accompanying change of melt topology still play an important role. This poster shows numerical simulations that have been performed using the numerical simulation package Elle and the finite element code Basil. While grain boundary migration is simulated using Elle (a front-tracking model), Basil simulates the deformation of the microstructure.

The aim of this study is to investigate topology changes of a microstructure and the localization of strain during deformation.