39th Meeting of the French Rheology Group (GFR)

13.-15.10.2004
Mulhouse, France

The 39th meeting of the French Rheology Group (GFR) has been held in Mulhouse from October 13th to 15th 2004. The topic of the meeting was "Rheology and Interfaces". Members of the Laboratoire de Physique et Mécanique Textiles and of the Institut de Chimie des Surfaces et Interfaces have been associated in the organizing committee. One of their objectives was to promote exchanges and discussions between specialists of rheology and of physical-chemistry of surfaces and interfaces. More than 130 scientists from academic and industrial laboratories have attended the meeting. The presence of exhibition stands of nine companies allowed everybody to discover the last developments of measurement techniques both in rheology (Anton Paar, Malvern, MTS Systèmes, Sodexim, Swantech, TA Instruments, Thermo Electron) and interfacial measurements (Krüss, GBX Instruments).

Each day was introduced by a plenary lecture. The first, given by Pierre Attané from the Laboratoire de Rheologie of Grenoble University, concerned the influence of the rheology of inks in the continuous printing ink jet process. He showed the importance of characterization of the inks at high frequencies and of the measurement of the transient elongational viscosity. Then, it is necessary to use non-conventional rheometers specially designed for this purpose. David Quéré (Collège de France) presented the second lecture entitled: The liquid-liquid impact: the art of samovar. He discussed the air drawing when the velocity exceeds a critical value and he presented very fascinating experiments. The third lecture was proposed by Guy Nemoz (Institut Français du Textile et de l'Habillement, Lyon). He gave a large synthesis on the rheology in textile processes including spinning of polymer melts, coating, impregnation of textiles, ageing of materials such as geotextiles or membranes for architecture.

The general topics of the conference "Rheology and Interfaces" covers a wide variety of problems and opens research fields as it has been shown through the 33 oral communications and the 35 posters which have been presented. An analyze of the contents of the papers shows that different kinds of interfaces have been considered: liquid-gas, liquid-liquid, liquid-solid, solid-solid. Then, several families of materials are explored: foams, emulsions, eventually filled with solid particles, dispersions, and granular media. The study can be done at different scales from macro-, micro- to nano- and molecular one. Experimental research in that field often combines conventional rheometry and other measurement techniques, especially spectroscopy or imaging. Instruments are also specially designed for the rheology of thin films or materials in a confined space and some papers were at the interface between rheology and tribology or nano-tribology.

The knowledge of the mechanical properties of thin films and of membranes has a great importance in a lot of applications such as, for instance, lubrication or design of adhesives. Several contributions concerned the measurement of the rheological properties of materials in confined geometries by means of a piezorheometer or a surface force apparatus. Experimental data on interfacial rheology measurements have been reported. It mainly concerns the thin layer of surfactants adsorbed at the interface between two liquids or air and a liquid. The main technique is based on the bi-cone geometry. Other devices use the oscillating magnetic needle and the oscillating pendent drop to get the shear surface and the dilational surface rheological properties.

Granular media and powders involve solid-solid interfaces. Rheometry of powders requires specific instruments and a new powder rheometer has been presented. Phenomena such as particle segregation and migration are often important in the flow of such materials as well as in concentrated suspensions and the local structure is studied through imaging techniques (fluorescence, NMR, flow visualization with tracers) or spectroscopy. For very turbid media, a lot of information could be obtained by multiple polarized light scattering. IR thermography associated with speckle correlation gives an approach of the thermomechanical behavior of a polymer. The rheological properties of complex materials such as suspensions of solid particles in polymer solutions or in emulsions depend on the particle/fluid interfaces in the bulk. Several papers concern these problems, for instance, in the case of ceramic pastes, bentonite suspensions in polymer solutions, cements, self-compacting concrete pastes, suspensions of fibers with adhesive contacts.

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Rheological measurements are often coupled with rheo-optical ones. It is the case for the study of shear banding or of shear-induced structures in micellar solutions but also to investigate the coalescence, deformation and break-up of droplets in compatibilized polymer blends. Problems occurring in polymer melt processing have been treated either from experimental approach or numerical simulation such as for interfacial instabilities during the co-extrusion of compatible polymers. What happens at the material/flow device interface? This topics has also been considered by several participants in the case of granular media, of emulsions but also for simple liquids on smooth model surface for which experiments based on Near field Laser Velocimetry show that the assumption of no slipping at the wall is not so evident.

Posters owners and companies were given a short time to present their work or material during a special session. This certainly contributes to promote busy discussions. On Wednesday evening, an official welcome reception was offered at the Columns Hall of Mulhouse Town Hall. It was the opportunity to discover a part of Mulhouse history. The Swiss cantons coats-of-arms are represented on the frescoes of the walls of the town hall. It is a memory of the time when Mulhouse was a small republic allied with Switzerland (until the beginning of 19th century). For historical reasons, this situation promoted the wide development of textile manufactories, especially for textile printing. Thursday afternoon, a visit of the National Automobile Museum-Schlumpf collection was organized, followed by a drink in the environment of sumptuous cars (Bugatti Royale, ...) and by the conference dinner during which three awards have been conferred.

On Friday morning, the next GFR meeting has been presented by P. Navard (Sophia-Antipolis) and rendezvous is given to the rheologists at Nice in October 2005.

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