37TH MEETING OF THE FRENCH GROUP OF RHEOLOGY (GFR)

SAINT ETIENNE, FRANCE
OCTOBER 9TH - 11TH, 2002

The 37th meeting of the French Group of Rheology (GFR) was held in Saint Etienne (France) from October 9th to October 11th, 2002. More than 110 scientists, from laboratories, universities and industry have attended the meeting. Following the tradition of the French group, the meeting was organized with the participation of another group from Europe. This year, the German group (Deutsche Rheologische Gesellschaft) was represented by its president Manfred Wagner. The topics of the meeting was Rheology, Morphology, Structure. Four main lectures were presented namely by Manfred Wagner from the University of Berlin (Germany), Jan Vermant from Leuwen (Belgium), Thomas Schweizer from ETH Zürich (Switzerland) and Jean-François Palierne from ENS Lyon (France), the latter being the winner of the annual award of the French group. Thirty lectures and more than twenty posters were presented during the conference. Five companies (Anton Paar, Bohlin, Rheometric Scientific, TA Instruments, ThermoRheo) were exhibiting stands dealing with rheological techniques. Poster owners and companies were given a short time to present their work or material during the sessions.

One of the most striking features that emerges from the overall lectures is the increasing use of the visualization techniques combined with rheometry. Probably due to the arrival of such systems on the market (Rheoscope from ThermoRheo, Shearing device from Linkam Scientific Instruments, similar systems announced by others) in addition to home made existing devices (Peuvrel-Disdier at the CEMEF, Vermant in Leuven), there is an increasing number of papers showing the interest of such devices for the understanding of the flow of heterogeneous systems.

Examples were given by Sepehr from Montreal using the Rheoscope to show how the orientation of short fibres in molten polymers correlates with some viscosity or normal stresses anomalies during transient start-up shear flows with reversal of the flow direction. In these experiments, orientation phenomena were shown to be strongly hindered by neighbouring fibres. The main lecture of Jan Vermant was also devoted to the flow induced anisotropy of 2D concentrated dispersions of stable or concentrated colloidal dispersions (latex). The later been viewed by optical microscopy at the interface on the stagnation line of a simple shear flow. The techniques are not only used in the area of polymers but also widely used in cosmetics and pharmaceutics as shown by Laribi in their study of the dispersion of clays in water. Disdier-Peuvreul and the group of the CEMEF are conducting experiments on carbon-black filled systems in a home made device of contra-rotating disks that can fix one single particle in the observation field. In the continuation of their previous studies on the modes for the dispersion of fillers in melts, they now focus on the dispersion of impregnated aggregates. Crystallization during shear are investigated in Lyon by means of Lyncam systems. Deyrail has studied the changes of the morphology of molten polymer blends during the crystallization of the dispersed phase under shear. Competition between crystallization and rupture of fibrils was found to be a key parameter. Fulchiron showed the shear effect on the crystallization of PP which revealed the increase of the germination density in correlation with normal stresses taken as an indication of the strong alignment of molecules. Visualization in more complex flow have also been presented. Ainser tracks particles in a transparent internal mixer to assess the efficiency of the blending devices. Chaari studies the changes of the structure of dispersions in a squeezing flow.

Because of the increasing number of works on heterogeneous systems, more often rheology gets benefits from its combination with other physical techniques for the analysis of the state of dispersion or structure of the materials. Apart from visualization techniques already mentioned, most of the papers on heterogeneous media are using scattering (small angle light or X-ray scattering) for the characterization of the structure.

Indeed, from a material point of view, there is a renewed interest for investigation on systems with colloidal behaviour or strong interactions in the "nano world". This is probably related to the development of nano-composites at least in the area of polymers. Gelation and thixotropic behaviour of laponite clays in water

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was studied by Mongondry who shows that adsorption of polyoxyethylene on clay drastically changes the rheological behaviour and slows down the gelation process. Theoretical aspects and modelling of the rheological behaviour of grafted silica strongly interacting with a polystyrene matrix were presented by Dagreou from Pau. Solid properties were correlated with aggregation and dispersion of nano-latex in model composites by Oberdisse and Boué. Plateau modulus observed on low frequency oscillatory data on molten nano-composites based on polyolefins were attributed to a tridimensional network formed during the dispersion of the filler by Lortie from the University of Minnesota. By the same technique, Chartier in Le Mans shows the improvement brought to the dispersion of elastomeric nanoparticles of elastomers in polyolefins by compatibilization. Swelling and exfoliation of montmorillonite in organic solvents, monomers and during the polymerization is studied using rheology in Lyon by the group of Institut National des Sciences Appliquées.

Other investigations on heterogeneous systems were presented by the group of Saint Etienne on polymer blend morphology related to dispersion and coalescence or by the group in Pau on magnetorheological fluids oriented and aggregated in a rheometer by a magnetic field. Material undergoing strong changes of their rheological behaviour during the experiment inside the rheometer due to chemical reaction or physical gelation were presented by Dimier from CEMEF on polyurethane, Barres from Vitry, Verney from Clermont Ferrand and Cocard from Michelin on elastomers, Warlus from Paris on inorganic polymers or Carrot from Saint Etienne on starch.

Modelling of the material behaviour for polymer systems is going on especially in the polymer melt area because there now exist reliable methods and sufficient data for the characterization of the elongational behaviour. Main lecture by Schweizer from ETH Zurich has made the point of the experience on the Meissner elongational rheometer (or its commercial version RME from Rheometric Scientific). Manfred Wagner presented his on-going work on integral constitutive equations that are nowadays thermodynamically consistent. Thermodynamic consistency of temporary network models was also the purpose of the presentation of Palierne. Simulation and experiments on model flows are increasing our knowledge on the influence of the orientation of fibers (Chinesta in Paris), fillers (Cartault from Vitry) or pressure (Santanach-Carrera in Grenoble). Modelling and experiments on more complicated processes such as extrusion or injection are carried out by Béreaux in Oyonnax for polymers or Toutou on extrusion of minerals.

The high level of the conference and the originality of the topics and works addressed during this meeting assesses the vitality of the French Group of Rheology and the organizing committees of both the 37th and 38th meetings encourage rheologists to attend the next meeting in Brest in 2003.

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