XIII Italian Conference on Rheology

Brescia, Italy
September 7–10, 2014

The XIII Italian Conference on Rheology was held in Brescia, Italy, at the Università degli Studi di Brescia, on September 7–10 2014. The conference, that is the 13th conference of the Italian Society of Rheology, was organized by researchers of Università degli Studi di Brescia, Dipartimento di Ingegneria Meccanica e Industriale (conference chairman was F. Baldi, Assistant Professor of Materials Science and Technology), in cooperation with the Executive Board of the Italian Society of Rheology (Scientific Committee of the conference).

The Italian Conference on Rheology, held on a two-yearly basis, constitutes the main interaction opportunity for the members of the Italian rheological community. It provides rheologists, from both the academia and the industry, with a great opportunity to renew acquaintances and to learn about the latest researches in the various fields of interest. The conference was structured on eight oral sessions and one poster session, in which the delegates presented original contributions, regularly submitted and accepted by the Scientific Committee. The oral sessions were organized along themes mostly related to the types of fluids and systems examined; most of the works were of experimental type. A small set of invited talks (one plenary and three keynote lectures) was also organized.

The conference was opened with a plenary lecture on "Computational rheology: towards an 'in silico' rheometer?" given by P.L. Maffettone (Università degli Studi di Napoli Federico II, Italy). The lecturer reviewed the works at the basis of the development of computational codes able to calculate 'in silico' the rheological properties of complex fluids. Rheological predictions in rheometric flows for heterogeneous systems (suspensions and emulsions) were then reported. It was shown that computational techniques can provide information which complement the data obtained with conventional experimental approaches.

Food rheology was the theme of oral session 1. The first contribution dealt with the rheological behaviour of dough, studied by both dynamic oscillatory tests and uniaxial extension experiments, with the purpose to relate the pasta preparation conditions to the dough structure. The second work was on vegetable oils structured via organogelation; the preparation of olive oil/monoglycerides organogels and their rheological response were reported.

Oral session 2 was on polymer rheology. The central idea of the talks of this session was the development of either new experimental approaches or new data analysis procedures, in support of the research of relationships between macromolecular structure and macroscopic properties. The attention was focussed on: shear-start-up runs, repeated after different rest times, on branched styrene-butadiene rubbers (SBR); chromatographic analyses with viscosimetric detector (GPC-visc) on samples of branched polyethylene (low-density polyethyl-

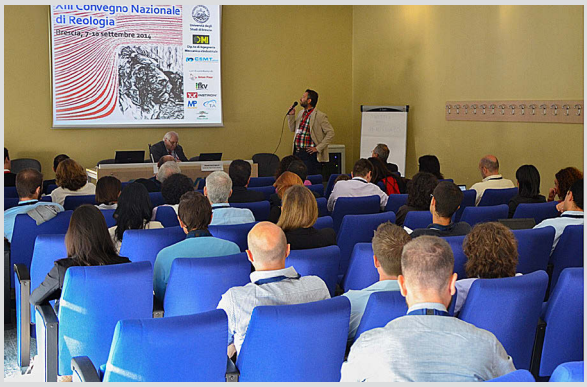

Figure 1: Opening of the conference, chaired by B. De Cindio (Università della Calabria, Italy, and President of the Italian Society of Rheology). Opening address by F. Baldi (standing).

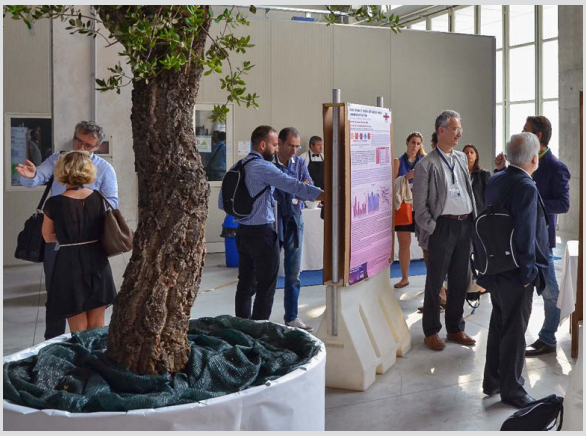

Figure 2: Participants at the poster session.

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ene, LDPE) from tubular and vessel reactors; a new rotational rheometer based on the combination of two electronically commutated synchronous motors placed opposite to each other.

G. Tomaiuolo (Università degli Studi di Napoli Federico II, Italy) gave the first keynote lecture, on "Hemorheology for industrial biotechnologies". Basic concepts were reviewed, and both whole blood rheological measurements and a fluid-dynamic analysis of red blood cell flow under microconfined conditions were reported. The former study was aimed at the development of specific medical devices, whereas the latter at the design of microfluidic-based diagnostic tools.

The talks of oral sessions 3 and 4 were about the rheology of systems for pharmaceutical and biomedical applications. In most of these works, rheological characterization was used as a tool to optimize the formulation of the systems under analysis and obtain the desired end-use performances. The systems investigated were: polymeric hydrogels able to provide an in situ controlled antibiotic release for orthopaedic implants; polymeric hydrogels containing nucleic acid based drugs to be used with stents for the treatment of coronary restenosis; polymeric hydrogels for drug delivery from microcontainers; pectin-based emulsion-gels ('emulgels'); aqueous solutions of high methoxyl pectins.

R. Alfani (CTG S.p.A., Bergamo, Italy) gave the keynote lecture on "Rheology of cement-based mortars". In this talk, the rheological behaviour of two different types of mortars (for processes of casting into a mould and extrusion) was described, stressing the aspects more closely related to the characterization techniques. For the analysis of mortars for processes of casting a rotational rheometer Viskomat was used, whereas a specifically developed slit-die capillary rheometer was employed for the analysis of mortars for extrusion.

The rheology of fluids related to petroleum processing industry was discussed in the works of oral session 5. Talks on the rheological behaviour of petroleum coke-water slurries (to be used as liquid fuel in cement production), of heavy crude-oils, and of bitumen-based materials for road pavements were given. In this session, the possibility to employ rheometric techniques to monitor structure and composition of sludge from wastewater treatment plants was also discussed.

The rheology of multi-phase systems was the theme of oral session 6. The attention was focussed on emulsions and, more specifically, the emulsions analyzed were sunscreen formulations (both with liquid and with semi-solid behaviour) containing rheology modifiers, and polymeric nano-emulsions. A talk on the effects of fluid elasticity on droplet emulsification (for a silicon droplet phase in different continuous phases) was also given. With reference to systems for food industry, the interfacial rheological behaviour of pectins at the air/water and olive oil/water interfaces, and the rheological response of suspensions of solid meat particles in vegetable oil were described.

The third keynote lecture, given by M. Tassieri (University of Glasgow, UK), was on "Microrheology with optical tweezers: fundamentals and applications". The lecturer described the basic concepts of optical tweezers, which, in the field of microrheology, can be considered as exceptionally sensitive transducers able to resolve very small forces (≈ pN) and displacements (≈ nm). It was shown how optical tweezers can be used to determine the linear viscoelastic properties of fluids.

Micro-rheology was the main theme of oral session 7. In this session, it was described how microconfined flows can be used for: (i) the achievement of 3D particle focusing for suspensions in viscoelastic fluids and (ii) the measurement of interfacial rheological properties of emulsions (in a lab-on-chip device). The analysis of flows through porous media was also reported. From the discussion of the talks of sessions 6 and 7, the importance of the interfacial rheology in the study of the behaviour of multi-phase systems was highlighted.

The conference closed with a second oral session on polymer rheology (oral session 8). With respect to the previous session on polymers (oral session 2), in which the attention was mostly paid to fundamental aspects, the talks of this last session concerned with aspects more closely related to polymer processing and compounds. The phenomena of (i) electrification of polymer melts during extrusion and (ii) melt fracture of polymer melts filled with rigid particles were reported. The rheological behaviour of new nanocomposites based on polylactid acid (PLA) was also discussed.

An interesting poster session on the themes discussed in the various oral sessions was also held. In the poster exhibition area, the companies leader in the field of instruments for the rheological characterization of fluids showed the newest instrumental solutions. During the conference, the participants were given the opportunity to visit a winery in the Franciacorta region and to taste wines and food typical of this area, located between Brescia and beautiful Lake Iseo.

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