COURSE DESCRIPTION

Training Event	Advanced Rheology: extension
Course Presenters	Giovanni Ianniruberto, Qian Hung and Ole Hassager
No. hours (contact time)	16
No. hours (non-contact time)	12
Total number of hours	28 (1 ECTS)
Course level	Advanced
Evaluation	Active participation, analysis of data and report.
Language	English
Pre-requisites	At least two DoDynet elementary modules.

Course objectives

The participants should be able to design and perform experiments for the characterization of soft materials in non-linear extensional flow and to evaluate their results in terms of appropriate molecular models. Furthermore, the participants should be able to understand and explain the basis and functioning of molecular theories for networks of entangled polymers as well as unentangled networks of associating polymers.

COURSE DESCRIPTION

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Basic principles of extensional rheometry and possible sources of error.
Filament Stretching Rheometry (FSR) and dual cylinder wind-up techniques (SER and EVF). Construction of the linear viscoelastic envelope. Evaluation of viscous heating effects. End-plate slip off. End-plate instability. Gravitational sagging (EVF and SER). Delayed sample necking (EVF and SER). Slender filament approximation for evaluation of sample necking (FSR).

Molecular theories for networks of entangled polymers.
Entangled *vs.* cross-linked networks. Many-chain simulations. Single-chain models. Tube model. Reptation dynamics. Doi-Edwards theory. Stretch and orientation dynamics. Predictions in shear and elongational flows. Convective Constraint Release. Simple constitutive equations. Understanding the differences between solutions and melts. Flow-induced friction changes.

Advanced techniques in Filament Stretching Rheometry:
Small Angle Neutron Scattering. Observation and analysis of fracture.

Molecular theories for unentangled networks of associating polymers
Telechelic polymers. Critical micellar concentration. Impermanent networks of telechelic polymers. Linear and nonlinear viscoelasticity. Theories of the nonlinear response of unentangled impermanent networks. “Non-telechelic” polymers. Sticky Rouse model.