UCL Université catholique de Louvain

LMAPR2018

2012-2013

Rheometry and Polymer Processing

5.0 credits	30.0 h + 22.5 h	2q

Teacher(s) :	Bailly Christian (coordinator) ; Devaux Jacques ;
Language :	Français
Place of the course	Louvain-la-Neuve
Main themes :	The course is divided in six main chapters following an introduction : 0 Introduction to polymer processing and the phenomenology of rheometrical flows 1 Shear dominated flow : capillary flow, flow in a die and flow in a screw 2 Capillary and rotational rheometry 3 Elongational flow and rheometry 4 Processing and rheology of complex polymer systems : an introduction 5 Chemical aspects of polymer processing 6. Polymer processing technologies.
Aims :	The objective of the course is to familiarize the students with various aspects of polymer processing and rheometrical methods suited for polymers with a focus on thermoplastics. At the end of their classes, students will be able to understand and explain: 1. the scientific foundations of polymer processing (physical as well as chemical aspects); 2. the main measurement methods of polymer rheology and their scientific basis; 3. the fundamentals of the rheological behaviour of complex polymer systems; 4. the major polymer processing technologies and rheometrical techniques. Moreover, the students will be able to use the concepts for the resolution of concrete problems in the context of case studies and laboratories. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Content :	Methods: Ex cathedra course completed by invited seminars and seminars prepared and presented by the students; plant visits; laboratories (processing and rheometry). Illustration of concepts by concrete exemples taken from industrial practice and the experience of the teachers. Contents: 0 Introduction 0.1 the world of polymer processing 0.2 the rheological zoo 0.3 reminder about continuum mechanics 0.4 phenomenology of rheometrical flows 1. Shear dominated flows 1.1 Flow in a capillary : effects described by the generalized Newtonian model 1.2 Flow in a capillary : effects not described by the generalized Newtonian model 1.3 Phenomenological and molecular explanation of viscoelastic effects 1.4 Flow in a die and a screw (characteristic curves) 2 Capillary and rotational rheometry 2.1 Capillary rheometry : wall shear stress and shear rate; critical analysis of assumptions 2.2 Rheo-optical methods 2.3 Small amplitude oscillating shear rheometry: dynamic moduli, mastercurves 2.4 Startup shear flow : overshoots and instabilities 2.5 Linear/non linear measurements : equivalence principles 3 Elongational flow and rheometry 3.1 1D analysis of filament drawing : pinching and draw resonance 3.2 Methods for measuring elongational viscosity 4 Processing and rheology of complex polymer systems : a introduction 4.1 Dispersion and coalescence in biphasic polymer blends 4.2 Suspensions and (nano)-composites: viscosity, yield stress, thixotropy 5 Chemical aspects of polymer processing 5.1 Mechanisms of thermal degradation 5.2 Mechanisms of thermal stabilization 6 Polymer processing technologies and applications Selection from : extrusion, injection molding, thermoforming, film biaxial orientation, blow molding, calendering, reactive polymer processing

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Other infos :	Prerequistes: MAPR2019 or equivalent and an introduction to continuum mechanics. Written support : reference books and lecture notes.
Cycle and year of study :	> Master [120] in Chemical and Materials Engineering > Master [120] in Mechanical Engineering > Master [120] in Chemistry and Bio-industries
Faculty or entity in charge:	FYKI