## Rheometry and Polymer Processing

**5.0 credits**  
30.0 h + 22.5 h  
2q

### Teacher(s):
Van Ruymbeke Evelyne ; Bailly Christian ;

### Language:
Français

### Place of the course:
Louvain-la-Neuve

### Inline resources:

### Main themes:
I. Introduction : industrial polymer processing, non Newtonian fluids, continuum mechanics refresher  
II. Shear viscosity, normal forces and elongational viscosity: observations and phenomenological models  
III. Flow through a channel  
IV. Capillary rheometry and extrusion defects  
V. Origin of viscoelastic effects; notions of rheological models; introduction to processing flow simulation  
VI. Cone-plate and plate-plate rheometric flow; Elongational flow  
VII Major industrial polymer processing operations : rheological aspects, technology and applications

### Aims:
Contribution of the course to the program objectives  
With respect to the LO of the programme KIMA, this activity contributes to the development and acquisition of the following LO:  
-- LO 1 : 1.1, 1.2  
-- LO 3 : 3.1, 3.3  
-- LO 4 : 4.1, 4.2, 4.4  
-- LO 5 : 5.1, 5.3, 5.4, 5.5, 5.6  
Specific learning outcomes of the course  
At the end of this course, the student will be able to  
-- LO1.1. : Understand and explain the scientific concepts underpinning polymer processing and rheometry  
-- LO1.1. : Understand and explain the functioning of major polymer processing operations and rheometry techniques  
-- LO1.2. : use relevant models and theories described in literature to predict the functioning of major polymer processing operations and corresponding rheometric measurements  
-- LO3.1 : document and summarize the scientific, technological and industrial state of the art for a particular class of polymer processing operations or rheometric measurement method  
-- LO3.3 : prepare a report on the state of the art and current challenges/perspectives for a particular class of of polymer processing operations or rheometric measurement method  
-- LO4. : work in team to analyze an issue and prepare a seminar + a report for a given class of polymer of polymer processing operations or rheometric measurement method  
-- LO5. : present and defend a seminar and a report on polymer processing or rheometry in a rigorous, up to date and attractive way, with the right balance between the parts on scientific, technological and industrial practice aspects.  
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”.

### Evaluation methods:
The students will be individually graded based on the objectives indicated above. More precisely, the evaluation involves the grading of:  
-- The presentation of a project in groups of two or three on a scientifically challenging and industrially relevant issue linked to the course content. This project will carry 1/3 of the total mark.  
-- A report on a laboratory and/or a simulation projet on polymer processing or rheometry. This report will carry 1/6 of the total mark.  
-- An oral exam based on a list of synthetic questions prepared by the teachers and given during the year. The exam will carry 50% of the mark  
-- The teachers have the right to reduce the weight of one part of the mark if a deep deficiency (& t;8/20) is found for the other.
| Teaching methods: | A combination of:  
Ex cathedra courses: concepts are illustrated by concrete examples taken from industrial practice and the experience of the teachers.  
Rheometry laboratory and/or processing simulation project  
Seminars prepared and presented by the students  
Laboratory and plant visits |
|---|---|
| Content: | I. Introduction: industrial polymer processing, non-Newtonian fluids, continuum mechanics refresher  
II. Shear viscosity, normal forces and elongational viscosity: observations and phenomenological models  
III. Flow through a channel  
IV. Capillary rheometry and extrusion defects  
V. Origin of viscoelastic effects; notions of rheological models; introduction to processing flow simulation  
VI. Cone-plate and plate-plate rheometric flow; Elongational flow  
VII. Major industrial polymer processing operations: rheological aspects, technology and applications |
| Bibliography: | Lecture notes on icampus, books from library according to subjects |
| Other infos: | This course requires basic knowledge of polymer science and continuum mechanics |
| Cycle and year of study: | Master [120] in Chemistry and Bio-industries  
Master [120] in Computer Science  
Master [120] in Civil Engineering  
Master [120] in Mathematical Engineering  
Master [120] in Computer Science and Engineering  
Master [120] in Biomedical Engineering  
Master [120] in Mechanical Engineering  
Master [120] in Electrical Engineering  
Master [120] in Chemical and Materials Engineering |
| Faculty or entity in charge: | FYKI |