INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

DPT GENIE MECANIQUE
INSA Campus LyonTech - DPT GENIE MECANIQUE - bât. J. FERRAND
12, des rue des sports - 69621 VILLEURBANNE
Phone 0472436226

Fluid and Thermal Mechanics

Polymer and Composite Processing 1

IDENTIFICATION

CODE : GM-4-S1-EC-PCPMF
ECTS : 3.0

HOURS

Lectures :	12.0 h
Seminars :	10.0 h
Laboratory :	16.0 h
Project :	0.0 h
Teacher-student contact :	38.0 h
Personal work :	25.0 h
Total :	63.0 h

ASSESSMENT METHOD

2-h examination and practical work reports or presentations

TEACHING AIDS

Manuscripts of lessons, exercice lessons and practical works

TEACHING LANGUAGE

French

CONTACT

MME BARRES Claire
claire.barres@insa-lyon.fr

AIMS

Knowledge:
polymers, composites, processing, process parameters, processing tools, physical phenomena

To be able to :
- choose a process for a specific production
- explain the operation of polymer and composite processing techniques
- adjust the main operating parameters of a process in a well-argued manner
- implement thermal or flow computations in polymer processing situations
- do the dimensioning of a tool for a given production

CONTENT

A Extrusion - Course (6h) Overview of single-screw and two-screw technologies. Transport mechanisms, fusion/plasticization, flows. Analytical models in functional areas. Defects, dimensional problems. Elements of technology and design of dies. Exercise lessons (4h) Modelling of the melted flow zone, characteristic curves, coupling screw-dies. Modelling of plasticization in single-screw devices. Flows in twin-screw devices. Practical works (8h) 1-Single-screw extrusion: operating parameters, pressure-pressure relationship, and residence time. 2-Extrusion-blow moulding.
B Composite forming processes -Introduction to Liquid Composite Molding (LCM) processes and pre-impregnated composite forming processes: Course (4h): Principles. Applications. Forming steps and associated physical phenomena. Advantages and drawbacks (i) deformation phenomena of dry and impregnated reinforcements for long-fibre composite materials, (ii) impregnation phenomena, and (iii) flow-induced structure short-fibre reinforcements.
Exercise lessons (4h): theory on the flow of fluids in porous and fibrous media. Practical work (4h): development of a composite part by the compression of Sheet Molding Compound. Links between forming parameters and forming defects. Practical work (4h): fabrication of a composite part by RTM. Links between process parameters and forming defects.

BIBLIOGRAPHY

[1] Flow and Rheology in Polymer Composites Manufacturing, Volume 10, 1st Edition, Editors: S.G. Advani, Elsevier, Amsterdam, Pays-Bas, 1994.
[2] Manufacturing Techniques for Polymer Matrix Composites (PMCs), 1st Edition, Editors: Suresh Advani Kuang-Ting Hsiao, Woodhead Publishing, Cambridge, Royaume Uni, 2012.
Polymer Extrusion, 4ème ed. C. Rauwendaal ; Hanser Publishers (2001)
[3] Screw Extrusion, Science and Technology. J.L. White, H. Potente ; Hanser Publishers (2001)
[4] Extrusion Dies for Plastics and Rubber, Design and Engineering Computations, 3ème ed. W. Michaeli ; Hanser Publishers (2003)

PRE-REQUISITE

Materials science (SIMS 3GM) and rheology (RMP 3GM), basic concepts of fluid mechanics, basic concepts of design