

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, exercise
lessons and practical works

TEACHING LANGUAGE

French

CONTACT

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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