University *of Ljubljana*
Faculty *of Mechanical Engineering*

Rheology of Polymers 5 ECTS

Lecturer: **Assist. Prof. Dr. Lidija Slemenik Perše**

Lectures: 30h | Tutorials: 18h | Labs: 12h | Project: 65h | Lang. :

Objectives

The objectives of this course are to understand the importance of rheology for polymer materials, to understand the determination of rheological properties and interpretation of the obtained results, to learn about the importance of rheological properties in mechanical engineering, and in R&D, to understand the scientific literature in the field of rheological properties of polymers in mechanical engineering. With this course student will get the following competences:

- application of rheological properties for polymer products,
- the ability to analyze the experimental results of rheological tests,
- the ability to apply rheological properties in special process applications,
- the ability to use rheological properties in R&D,
- the ability to analyse the published scientific results.

Programme

- INTRODUCTION (Basic rheological parameters, Material functions in time and frequency domain, Basic flow regimes), RHEOMETRY (Instruments, sensor systems, methods and tests, rheological parameters), YIELD STRESS (Engineering examples, determination and prediction of yield stress behaviour), VISCOELASTICITY (Creep and relaxation, energy absorption, mechanical models, material functions), LINEAR THEORY of VISCOELASTICITY (Linear and non-linear behaviour, practical meaning, determination of stress limit), TIME DEPEDENCY (Relaxation time, thixotropy, physical aging, mechanical spectra), EFFECT of TEMPERATURE (Temperature tests, Determination of phase transitions, Degradation), RHEOLOGICAL MEASUREMENTS (Selection of proper rheological method, Interpretation of the results, structure - properties relation), IMPORTANCE of RHEOLOGICAL PROPERTIES of polymer materials in RESEARCH and DESIGN (Relation of rheological properties of melt with process parameters, viscoelastic properties during processing, Influence of time dependent properties on the performance (mechanical properties) and life-time of polymer products, SPECIAL APPLICATIONS of rheological properties of polymers in mechanical engineering

Prerequisites

Meeting the enrolment conditions for the Master's study programme of Mechanical Engineering - Research and Development program.

Learning outcomes

In-depth theoretical and practical knowledge of rheological properties of polymers with the emphasis on mechanical engineering applications.

- Selection of basic methods for determination of rheological properties of polymers.
- Application of rheological methods for prediction and interpretation of rheological behaviour of polymers in real process applications.

Assessment

- 40% Theoretical part (lectures)
- 30% Individual work during laboratory practice
- 30% Laboratory work (report included

Literature

- Shaw M.T.: Introduction to Polymer Rheology, John Wiley & Sons, 2012
- Ferry J.D.: Viscoelastic Properties of Polymers, John Wiley & Sons, 1980
- Osswald T.A., Rudolph N.: Polymer Rheology Fundamentals and Applications, Hanser Publishers, 2014