



**UNIVERSITY of MISKOLC**  
**Faculty of Materials Science and Engineering**  
**Antal Kerpely Doctoral School of Materials**  
**Science & Technology**



# Polymer processing

Dr. Károly Belina

## **COURSE DESCRIPTION**

2020.

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## Lecturer

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## Recommendation

The lecture is proposed for all students of the Kerpely doctoral school, especially in the field of polymer science and technology.

## Language

Hungarian or English.

## Scope

Aim of the course is to interpret the up to date polymer processing technologies. It also shows the correlations between the processing parameters and the properties of the final product.

## Methodology

Consultation. Students survey the topics followed by a discussion on it.

## Topics

### 1.Topic

#### **Connection between processing and properties.**

Properties of materials which determine processing.  
Property changes due to the processing.  
Material testing connecting to the processing.

#### **Basic questions:**

1. *What are the thermal properties of plastics?*
2. *How can be measured the thermal conductivity?*
3. *Determine the enthalpy change on heating!*
4. *How can the flowability of polymer melts be determined?*
5. *How do the viscosity of polymer melts change with flow rate?*
6. *What structural change occurs during the flow of polymer melts?*
7. *How does the pressure affect the polymer materials flowability?*
8. *What material properties determine whether a polymer needs to be dried?*
9. *What equipment is suitable for drying of polymers?*
10. *How can the moisture content of polymers be determined?*

### 2.Topic

#### **Processing of thermoplastics**

Extrusion and extrusion-based technologies.  
Injection moulding technologies, mainly special methods.  
Reactive extrusion and injection moulding  
Manufacturing defects in extrusion and injection moulding

#### **Basic questions:**

1. *What transfer processes take place in extrusion?*

2. *How to produce an exact size by extrusion?*
3. *What is the flow in the extruder screw?*
4. *What is the operating point of the extruder and how is it affected by the screw speed?*
5. *What are the elements of an injection moulding cycle?*
6. *What is the difference between 2C and 2K injection moulding?*
7. *What is reactive extrusion?*
8. *What is RIM?*
9. *What gate geometries are used in the injection moulding tool?*
10. *What causes and how to reduce the flash formation?*

### **3.Topic**

#### **Processing thermosets**

Components of composite systems

Differences between processing technologies of thermoplastics and thermosets.

RTM technologies

Processing of SMC, BMC and DMC materials

#### **Basic questions:**

1. *What are the components of composite systems?*
2. *What reinforcing materials are used in thermoplastic polymer composites?*
3. *What are nanocomposites and how can they be processed?*
4. *What considerations should be done in injection molding tools for long fiber reinforced thermoplastics?*
5. *What is the shape fixation for thermosetting materials?*
6. *What is manual lamination, what are the advantages and disadvantages?*
7. *What is vacuum bag technology and what are its advantages and disadvantages?*
8. *What is compression injection moulding?*
9. *What are the methods for flash-free production in rubber processing?*
10. *What are the advantages and disadvantages of processing SMC, BMC and DMC materials?*

### **References**

1. Osswald, T., Hernandez, J.: Polymer Processing, Modeling and Simulation, Hanser, 2006
2. Advances in Polymer Processing (Ed.: Thomas&Young), Woodhead Publishing, 2009
3. Osswald, T., Menges, G.: Materials Science of Polymers for Engineers 3E, Hanser, 2012

### **Exam**

Oral exam.

#### **Complex exam questions**

1. What are the material properties that determine the processing of plastics? Based on these, how would you group the processing technologies?
2. What state-of-the-art material testing techniques are available to characterize polymers from a processing technology perspective?
3. What is the basis for selecting the production technology of a polymer product?
4. What state changes take place during the processing processes?
5. Processing defects in the production of polymers, their appearance and material structural causes.