



GrInShield

Summer school “Polymer technology – processing and manufacturing”

26.-28. June 2024, Slovenj Gradec, Slovenia; Faculty of Polymer Technology

The Summer school is aimed at students and researchers who work with polymers and want to gain a better insight into polymer processing. The Summer school is organised within the framework of the EU-funded GrInShield project. **Participation is free of charge, but registration is required.**

Participation is possible both on-site and online, for both lectures and experimental work.

Registration:

You can register here! <https://forms.office.com/e/D8XayC7REa>

Program:

Wednesday, 26. 6. 2024

| Time | Lecturer | Topic |
|-------------|-------------------|--|
| 8:30-8:45 | B. Nardin | Welcome |
| 8:45-9:00 | S. Jovanović | Presentation of the Grinshield project |
| 9:00-10:30 | B. Nardin | Introduction to polymer processing |
| 10:30-11:00 | Coffee break | |
| 11:00-12:30 | W. Friesenbichler | Rheology of Polymers and its Importance for Processing |
| 12:30-13:30 | Lunch | |
| 13:30-14:15 | B. Nardin | Injection moulding |
| 14:15-15:00 | B. Nardin | Thermoforming |
| 15:00-15:15 | Coffee break | |
| 15:15-16:00 | J. Slapnik | Tailoring properties of plastics by compounding |



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Thursday, 27. 6. 2024

| Time | Lecturer | Topic |
|-------------|--------------------------------|---|
| 9:00-10:30 | M. Hriberšek | Overview of additive technologies |
| 10:30-11:15 | J. Slapnik | VAT photopolymerization additive manufacturing |
| 11:15-11:30 | Coffee break | |
| 11:30-13:00 | M. Hriberšek | Preparation of 3D models for additive manufacturing |
| 13:00-14:00 | Lunch | |
| 14:00-16:30 | Lab tour | Demonstration of processing technologies & Production of filament for 3D printing |
| 18:00 | Dinner at the Guesthouse Murko | |

Friday, 28. 6. 2024

| Time | Lecturer | Topic |
|-------------|----------------------------|---|
| 9:00-13:00 | M. Hriberšek J. Slapnik | Practical work on additive technologies |
| 13:00-14:00 | Lunch | |
| 14:00-16:45 | M. Hriberšek J. Slapnik | Practical work on additive technologies |
| 16:45-17:00 | Closing ceremony | |

Brief description of topics:

Introduction to polymer processing:

Plastic materials are one of the most commonly used materials in the world. There are many different processing technologies, which are used for it. In this lecture, the participants will get an overview of plastic processing technologies and their fields of application.

Rheology of Polymers and its Importance for Processing

Understanding polymer processing and its optimization without profound knowledge of polymer rheology is nearly impossible. In this presentation, the characterization of rheological key figures such as viscosity, storage and loss moduli as well as viscoelasticity and its impact on simulation and processing will be demonstrated using the example of various practical parts being in production.



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Injection moulding

Injection moulding is one of the most common technologies for the production of plastic parts, since is a highly effective and cost-competitive technology for high-series production. To effectively produce high-quality plastic products, one must take into account 4 pillars:

- Plastic material
- Plastic part design
- Mould for injection moulding
- Injection moulding technology.

All four pillars are linked to each other and the topic will cover the basics of all four pillars so that the participants will be able to understand the injection moulding process.

Thermoforming

Thermoforming is a process where different plastic sheets are transformed into the final shape. The technology is used for the production of different products in industrial branches like the automotive and household industries, packaging, etc. During the course, the student will get knowledge about different thermoforming processes, which define different product geometries, needed tools and machines.

Tailoring properties of plastics by compounding

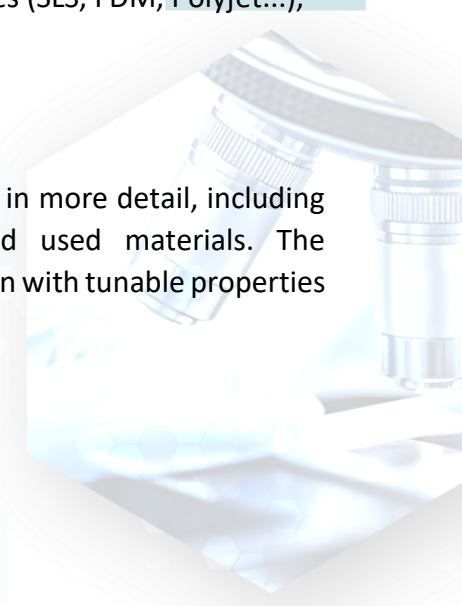
Compounding has emerged as the main strategy for the development of new plastic materials for different applications. The lecture will discuss the advantages of plastic compounding compared to traditional approaches for developing polymeric materials with new properties and how compounding can be employed to tailor the properties of plastics with particulate fillers and additives.

Overview of additive technologies

Definition of the additive manufacturing process. Comparison between additive manufacturing technologies and conventional production technologies. An overview and description of basic principles of the most commonly used additive manufacturing technologies (SLS, FDM, Polyjet...), list of used materials and connection with applications.

VAT photopolymerization additive manufacturing

This lecture will present vat photopolymerization additive manufacturing in more detail, including basic principles, different vat photopolymerization technologies and used materials. The development procedure of photocurable resins for vat photopolymerization with tunable properties based on acrylate chemistry will be presented.



Preparation of 3D models for additive manufacturing

As part of the work of preparing models for 3D printing, the basic features (Solid Modeling: extrude, pocket, shell, edge fillet, chamfer etc...) of modelling in the NX12 program will be demonstrated on the example of designing a cover for this smartphone. Each participant will be able to design their phone case. In the next step, the CAD models will be converted to a suitable format (STL) that supports 3D printing.

Demonstration of processing technologies & Production of filament for 3D printing

During a guided tour through the Polymer Processing Laboratory at FTPO, the polymer processing techniques, previously explained in lectures, will be presented (injection moulding, extrusion, thermoforming, as well as laser engraving).

Practical work on additive technologies

In the experimental work on the machine, in the field of selective laser material sintering technology (SLS), the aforementioned technique will be presented together with the entire implementation procedure, which includes material preparation, machine setting, 3D printing and post-processing of the printed pieces. Demonstrations in the form of logos or smartphone cases will be printed.



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