

Theory and Practice of Wet Spinning of Cellulose Solutions

Doctoral Short Course, 5 ECTS



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School of Chemical
Engineering

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March 10 – 11, 2022

Course content

This PhD short course provides an overview of important theoretical and practical aspects of the sustainable production of textile fibres from cellulose in a very concentrated form.

In nine learning units, the most important topics related to wet spinning of cellulose solutions along the value chain are covered, starting with raw materials and ending with fibre properties.

The focus is on the fundamentals of cellulose dissolution, the characterisation and evaluation of the solution state, especially with regard to spinning behaviour and the structure formation of the fibres during coagulation and regeneration.

The short course is aimed equally at PhD students and chemists and engineers from industry. For doctoral students, we offer 5 ECTS credits for attending the course and subsequently solving assignments on the topic of the course.

Outline

1. Introduction, history

2. Pulps as raw materials

- Origin
- Characterization
- Methods for DP adjustment

3. Cellulose solvents

- Direct cellulose solvents
- Alkaline aqueous solutions with&without derivatization
- Practical aspects of cellulose dissolution including the assessment of solution

4. Theoretical aspects of cellulose dissolution

- Thermodynamics of polymer solutions (Flory-Huggins)
- Solubility parameters
- Molecular dynamics: NMMO/water/cellulose

5. Rheology of cellulose solutions

- Fundamentals
- Solutions with direct solvents
- Aqueous solutions

6. Coagulation and regeneration of cellulose

- Thermodynamics (phase behavior of polymer solutions)
- Dry jet-wet spinning
- Wet spinning with focus on viscose
- Others

7. Filament breaches during spinning

8. Types of MMCFs

9. Properties of MMCFs

- Mechanical properties
- Optical properties, dyeability
- Interaction with water

10. Students' Questions & Answers

Schedule

L1	Introduction, Raw materials	HS	March 10	10:00-10:45
L2	Cellulose solvents-1	HS	March 10	11:00-11:45
L3	Cellulose solvents-2, Cellulose dissolution-1	HS	March 10	12:00-12:45
	Break until 13:20. Group activity			13:20-13:55
L4	Cellulose dissolution-2	HS	March 10	14:00-14:45
L5	Rheology	MH	March 10	15:00-15:45
L6	Coagulation and Regeneration-1	HS	March 10	16:00-16:45
L7	Coagulation and regeneration-2	HS	March 11	10:00-10:45
L8	Filament breaches	MH	March 11	11:00-11:45
L9	Types and properties of MMCFs	HS	March 11	12:00-12:45
	Break until 13:20. Group activity			13:20-13:55
L10	Students' questions and answers	HS	March 11	14:00-14:45

HS: Herbert Sixta

MH: Michael Hummel