

# RESEARCH GROUP

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# Green Polymers

The Green Polymers group applies science and engineering principles to enable the more sustainable generation and use of polymeric materials.

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### Main expertise fields

- Generation of monomers, pre-polymers and filers from renewable resources  
Synthesis, formulation and structure-properties relations of bio-based / sustainable thermoplastics, thermosets and their composites  
Materials classes: aminoalcohols, benzoxazoles, cellulose / cellulosic, elastomers & rubbers, epoxy, fiber composites, interpenetrating networks, lignin, nanoparticles & nanocomposites, plant oils & derivatives, phenolic resins, polyesters, polysaccharides & derivatives, polyurethanes (conventional & non-isocyanate, foams), silicones, vinyl ester resins, vitrimers  
Process approaches: additive manufacturing, chemical recycling, compaction & nanoparticle processing, compression molding, extrusion, injection molding, mechanical recycling

### Characterization techniques: FT

- Research challenge**  
Design of monomers, (pre-)polymers and fillers with enhanced safety and sustainability in mind  
Extraction, isolation and chemical modification of monomers, (pre-)polymers and fillers from biomass  
Identifying of safer, more sustainable synthetic methods and re-/processing approaches  
Developing new approaches to manage the end-of-life of polymers and composites

#### **III. 11**

- Application areas
  - Additive manufacturing
  - Adhesives and coatings
  - Automotive and transportation
  - Biomedical applications
  - Electronics and electrical applications
  - High-performance polymeric materials
  - Packaging
  - Space & aerospace
  - Structural materials
  - New polymers and additives for tires

#### Main assets

- #### **Main assets**

### • Bio-derived materials

## CATBIOSE (ongoing)

- Hemicellulose-derived polyesters

Goodyear-LIST partnership (ongoing)

#### **• Bio-based process f.**

- Bio-based process & performance
  - Novel traction resins
  - Additive compatibility, migration

- Lignin-based benzoxazine resins

Other assets (academic & industrial)

  - Alternative thermoset, adhesive and coating formulations for industrial applications
  - Bio-based epoxies, vinylmers and fiber composites
  - Cardanol-based additives and polymeric materials
  - Lignin-augmented sealants and repair materials for industrial applications

- quipment**  
Anton Paar MCR 302 rheometer  
Christ Martin Alpha 3-LScasic freeze dryer  
LabThink VAC-VPS permeation analyser  
Masuda MKZIA10-20 Supermacolloid ultra-fine friction grinder  
Mbraun LABStar four-arm glove box  
Mbraun SPS-800 solvent purification systems  
Par 4564 benchtop carbon dioxide reactor  
Schenk lines  
Synthesis reactors up to 5 L

Top industrie custom-built polycones  
UV conveyer

- selected publications**

Schmidt, D. F. *Processing of polymer nanocomposites*. In *Industry Guide to Polymer Nanocomposites*, 1. ed.; Beyer, G., Ed.; A PD technology book; Plastics Information Direct: Bristol, 2009.

Durkuney, E.; Schmidt, D. F. *Understanding the Consequences of Interlayering Using Model Polymer Nanocomposites*. *Macromolecules* 2015, 48 (20), 7620-7630.

Puchot, L.; Verge, P.; Roquette, T.; Vancayzeele, C.; Viñals, F.; Habibi, Y. *Breaking the Symmetry of Dieneblockers: A Parallel Approach to the Synthesis of Block Copolymer-Based Thermoplastic*. *Green Chem.* 2016, 18 (11), 3346-3353.

Roquette, P.; Puchot, L.; Verge, P.; Vancayzeele, C.; Viñals, F.; Habibi, Y. *Thermotropic Three-Block Methacrylate-Based Thermoplastic*. *Green Chem.* 2017, 19 (10), 388-395.

Liu, W.; Reynaud, E.; Schmidt, D. F. *Effect of Selective Crosslinking and Chain Scission on the Thermal Properties of Polyesters*. *Ind Eng Chem Res* 2017, 56 (10), 2661-2672.

Trejo-Machin, A.; Verge, P.; Puchot, L.; Quintana, R. *Phenolic Acid as an Alternative to the Phenolization of Aliphatic Hydrocarbons for the Fabrication of Polyphenoxazone*. *Green Chem.* 2017, 19 (21), 5065-5073.

Valebenito, F.; Garcia, R.; Cruces, K.; Ciudad, G.; Chinga-Carrasco, G.; Habibi, Y. *CO<sub>2</sub> Adsorption of Surface-Modified Cellulose Nanofibril Films Derived from Agricultural Wastes*. *ACS Sustainable Chem Eng* 2018, 6 (10), 12603-12612.

Gesesse, G. D.; Li, C.; Pameau, E.; Habibi, Y.; Remita, H.; Collet, S.; Puchot, L.; Viñals, F.; Roquette, P.; Kassim, N. *Synthesis and Characterization of Sulfonated Cellulose Nanofibers*. In *Advances in Cellulose Nanofibers*; Cao, J. H. N., Gross, R. A., Smith, P. B., Eds.; American Chemical Society: Washington, DC, 2018; Vol. 1310, pp 281-295.

Gesesse, G. D.; Li, C.; Pameau, E.; Remita, H.; Collet, S.; Puchot, L.; Viñals, F.; Roquette, P.; Kassim, N. *Photogenerated Charge Carriers and Photocatalytic Activity of Biodegradable Metzgeroum-TG<sub>n</sub> From a Cross-Hemiacetal Structure*. *Chem Mater* 2019, 31 (13), 4861-4863.

Quirino, E.; Kasmi, N.; Dieder, R.; Callio, S.; Habibi, Y. *Incorporating Free Fully Butenediyl Star Polyester Urethane: Synthesis and Thermal Properties*. *Biomacromolecules* 2020, 21 (5), 1943-1951.

Trejo-Machin, A.; Adjoud, A.; Puchot, L.; Dieder, R.; Verge, P. *Elucidating the Thermal and Polymerization Behaviours of Benzoquinones from Lignin Derivatives*. *European Polymer Journal* 2020, 124, 109468.

**Partners**

University of Cergy-Pontoise, Fraunhofer Institute for Manufacturing Technology and Advanced Materials (IFAM), Goodyear Tire & Rubber Company, Roquette

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## Contact

5, avenue des Hauts-Fourneaux  
L-4362 Esch-sur-Alzette  
phone: +352 275 888 - 1 | LIST.I

Daniel SCHMIDT ([daniel.schmidt@list.lu](mailto:daniel.schmidt@list.lu))  
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