Master Thesis - Belgium

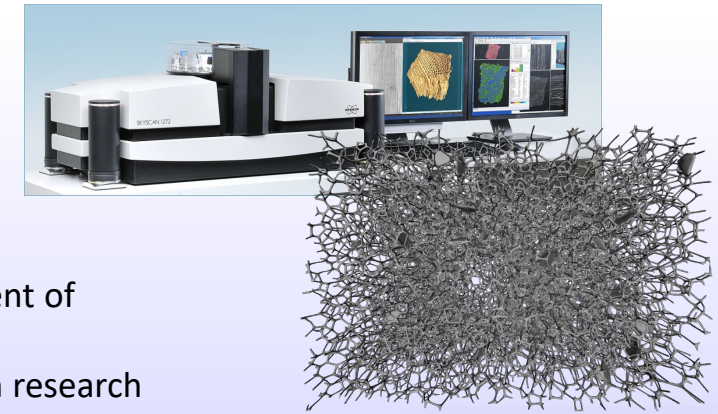
Engineering Student

Research Department, Huntsman Polyurethanes

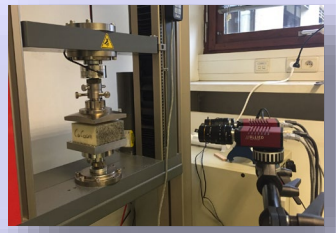
Duration of Placement: 6/12 Months

HUNTSMAN

Enriching lives through innovation

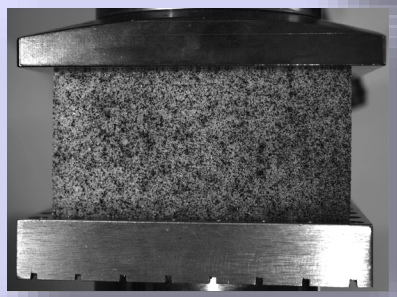


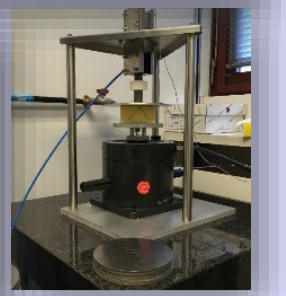
We are looking for an engineering student, with particular emphasis on computational physics, to work within our R&D function on the development of novel polyurethane materials.
The role will involve working in a highly multi-functional, innovation-driven research team which applies the very latest know-how and techniques in material characterization, material science, computational modelling and polymer chemistry to the development of new materials for a wide range of applications.



The skills we are looking for are:

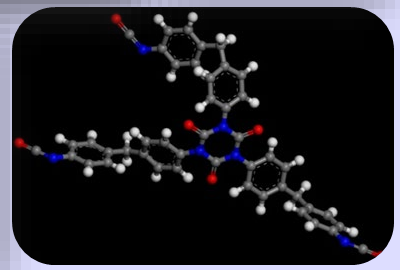
- Material science skills;
- Ability to execute and interpret material tests and simulation procedures;
- Initiative & creativity;
- Good team-working & communication skills (English language).





Huntsman offers:

- Enjoyable international working environment;
- Free accommodation in Leuven (University town).



Contact person: Dr. Martino Dossi, martino_dossi@huntsman.com

UNIVERSITÀ DEGLI STUDI DI BERGAMO

Local contact people

(ICAR/08 - Scienza delle Costruzioni):

Prof. Egidio Rizzi,
Prof. Giuseppe Cocchetti,
Dr. Rosalba Ferrari

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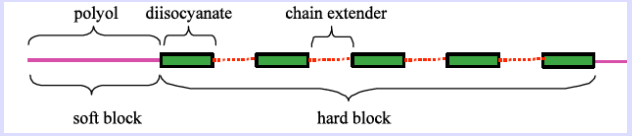
Possible research topics

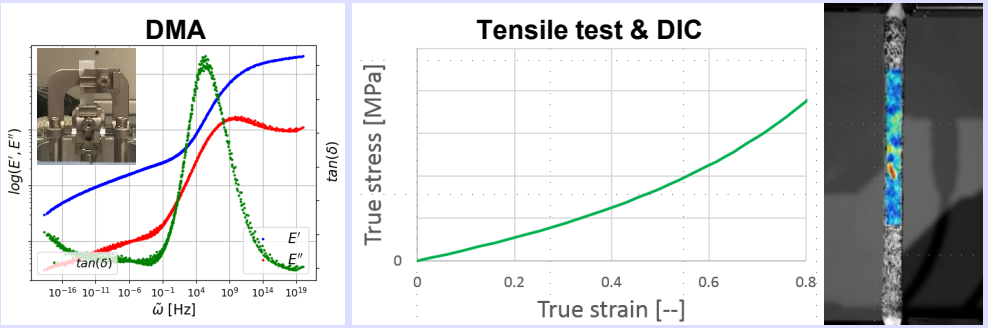
Study of the viscoelastic behavior of thermoplastic polyurethanes

Thermoplastic Polyurethanes (TPUs) are injected or extruded to produce a wide range of products such as footwear, wire and cable sheathing, hoses, tubing, film and sheet, or they are used to produce coated and laminated textiles, protective/functional coatings and adhesives.

TPU is a multi-phase block copolymer that is created when three basic raw materials are combined together in a specific way: a polyol ("soft block", responsible of flexibility and elastomeric character), a chain extender and a diisocyanate ("hard block", responsible of toughness, physical performance properties and temperature resistance).



Basic chemistry of TPU



Mechanical testing of a TPU material

Different requirements concerning physical properties and temperature resistance are necessary, depending on TPU applications. For that reason, it is of primary interest to study the time and temperature dependent physical properties of TPU materials and eventually their links to the polymer structure.
Dynamical Mechanical Analyzer is used to characterize TPU materials in the solid-like state, while rheometer is used to completely describe the viscoelastic behavior over the melting phase.

The work aims, through an accurate interpretation of material characterization, at obtaining the viscoelastic behavior of TPU materials over the entire temperature range and relating it to the TPU polymer structure.

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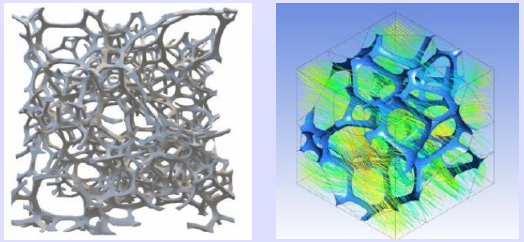
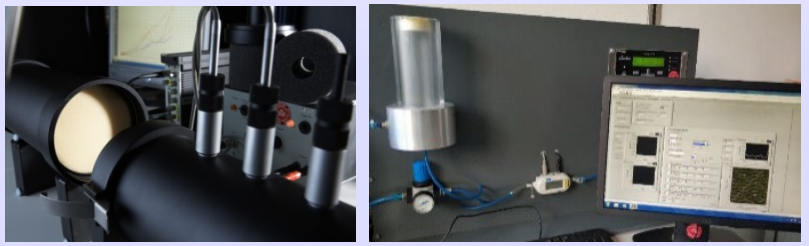
Possible research topics

Study of the Noise Vibration and Harshness (NVH) performances of polyurethane porous materials

Polyurethane (PU) foams are widely used as noise and vibration damping materials in various applications, e.g. in the automotive sector. Their porous random microstructure is composed of a viscoelastic frame structure with an interstitial fluid filling the voids. Acoustic and mechanical energy absorption properties and their direct link with microstructure morphology are therefore of paramount importance in the design, prediction and optimization of the material behavior.



PU porous material microstructure and air-borne FEM simulation of wave propagation



Impedance tube and air flow equipment

The work may include: firstly, a mechanical-acoustic characterization of PU porous materials (through impedance tube measurements and inverse analysis methodology); secondly, a wave propagation study in porous materials (analyzing energy transport through flow in pores, vibration transmission in solid frame and their multi-physics interaction).

This research aims to characterize PU materials in terms of vibro-acoustic properties, linking them to microstructure morphology, to predict and compare the NVH comfort levels of different materials and eventually to improve the microstructural design by adjusting the chemical formulation.

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