FACULTY OF ENGINEERING AND ARCHITECTURE

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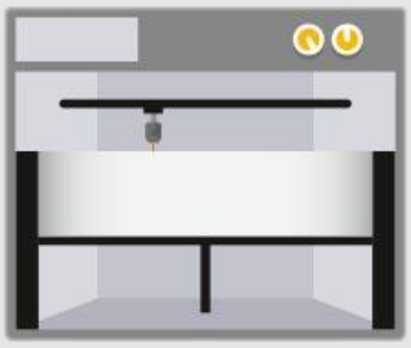
# POWDER BASED 3D PRINTING: OVERCOMING THE STUMBLING BLOCK OF MATERIAL SHORTAGE BY NOVEL PROCESSING ROUTES OF POLYMER PELLETS

## Powder based 3D Printing: Selective Laser Sintering

The 3D CAD model

A laser binds the powder particles on the building platform together



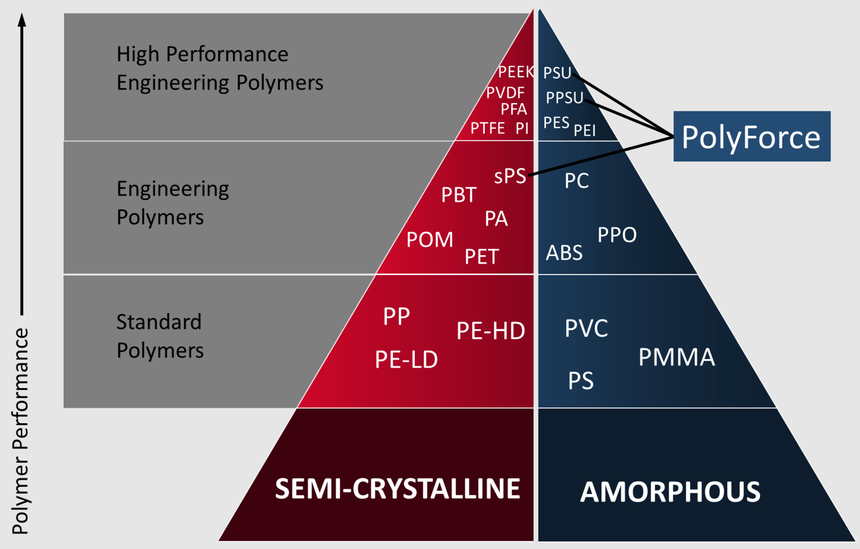
Successive powder layers are spread on top of each other, while a laser selectively binds the particles to form the part layer wise

Afterwards, the loose powder is removed and the product is cleaned

The part is finished

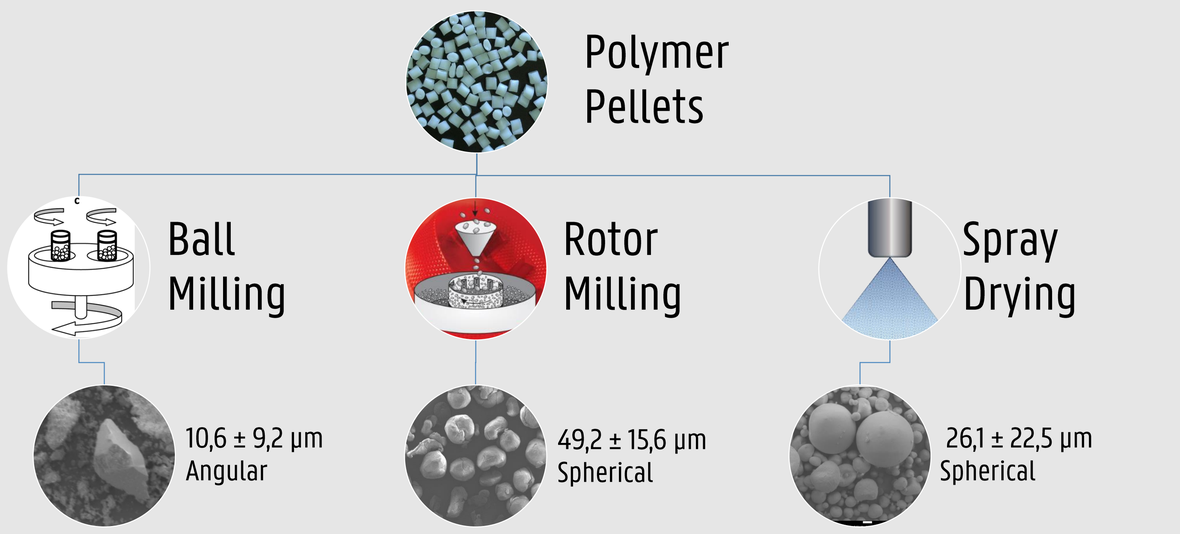
Selective Laser Sintering (SLS) is an additive Manufacturing technique with the ability to form complex 3D objects by sintering successive layer of polymer powder material with a CO2-laser.

## Material shortage as stumbling block



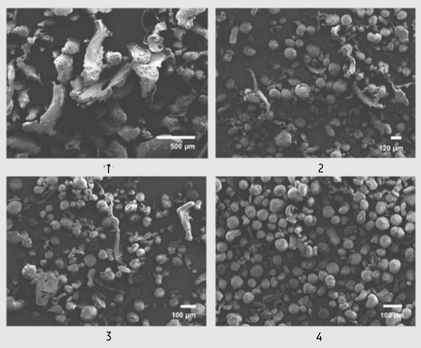

Currently, 95% of available materials for SLS consist of polyamide (PA) based polymers (*Wohlers Report*). This limits the possible applications for SLS to those within range of the properties of PA. Expanding this material palette would greatly improve this application window.
Within our Research group, the PolyForce program focusses on expanding this palette by processing three engineering polymers to novel feed material for powder based 3D printing.

## Novel processing routes to expand material palette

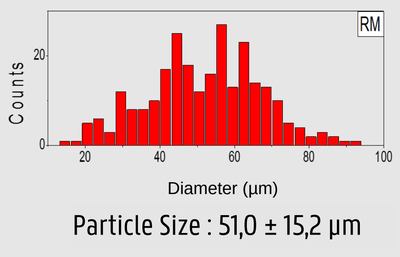



Polymer pellets are processed via novel processing methods, either mechanically by rotor milling or physicochemically by spray drying, into free flowing powders suitable for use as build material for SLS.
The powders created are tested on morphology, size, flowability, degradation before performing actual sinter tests in collaboration with the KU Leuven and Materialise.

## Example: Processing polysulfone into free flowing powders for SLS

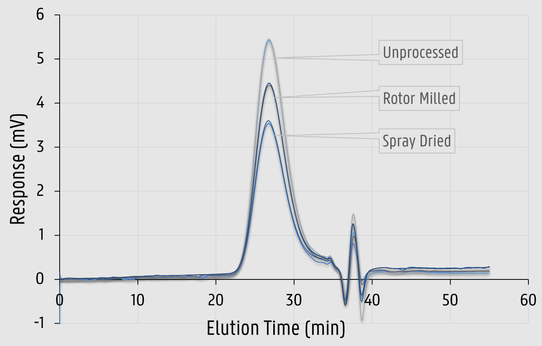



4-step milling process and sieving of polysulfone

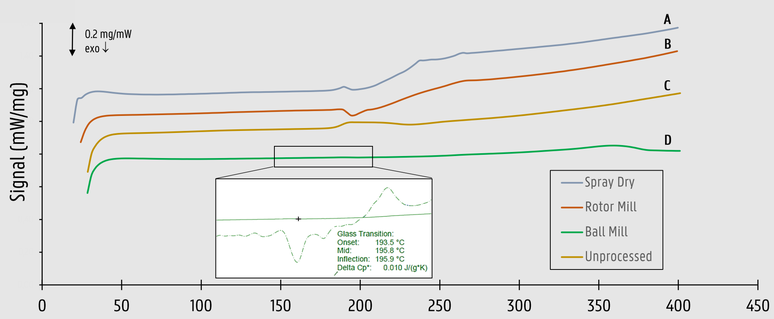



Particle Size : 51,0 ± 15,2 µm

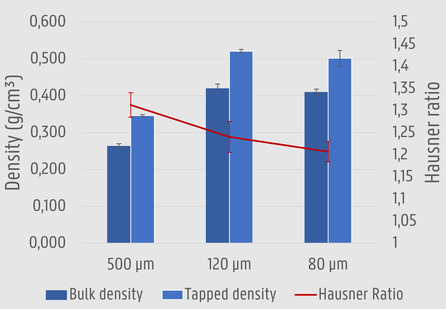
Particle Size Distribution of the final powder



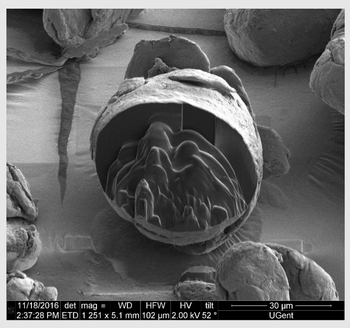

GPC measurements to test for degradation due to processing



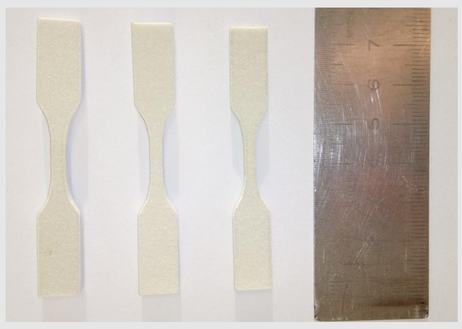

DSC measurements to test for any changes in thermal behavior due to processing




Hausner Ratio measurements to investigate powder flow




Density measurements of the particles themself by FIB-SEM



Actual sintered parts ready for tensile testing

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