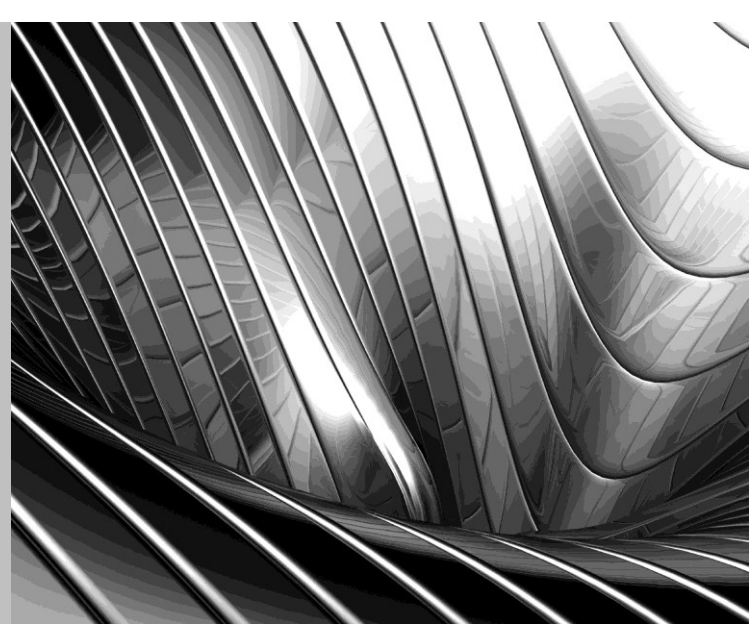
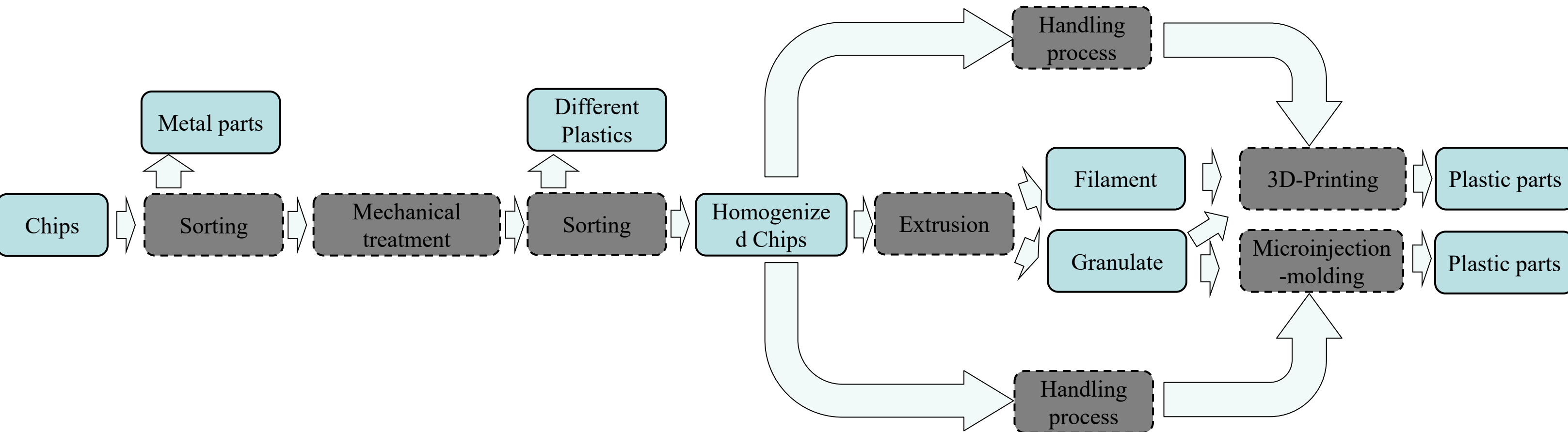




Plastic Chips as Feedstock for 3D-Printing-Processes

Christoph Doerffel, Susi Tosch, Barbara Meier, Carola Neumann, Mirko Spieler

Recycling Routes of Plastic Chips



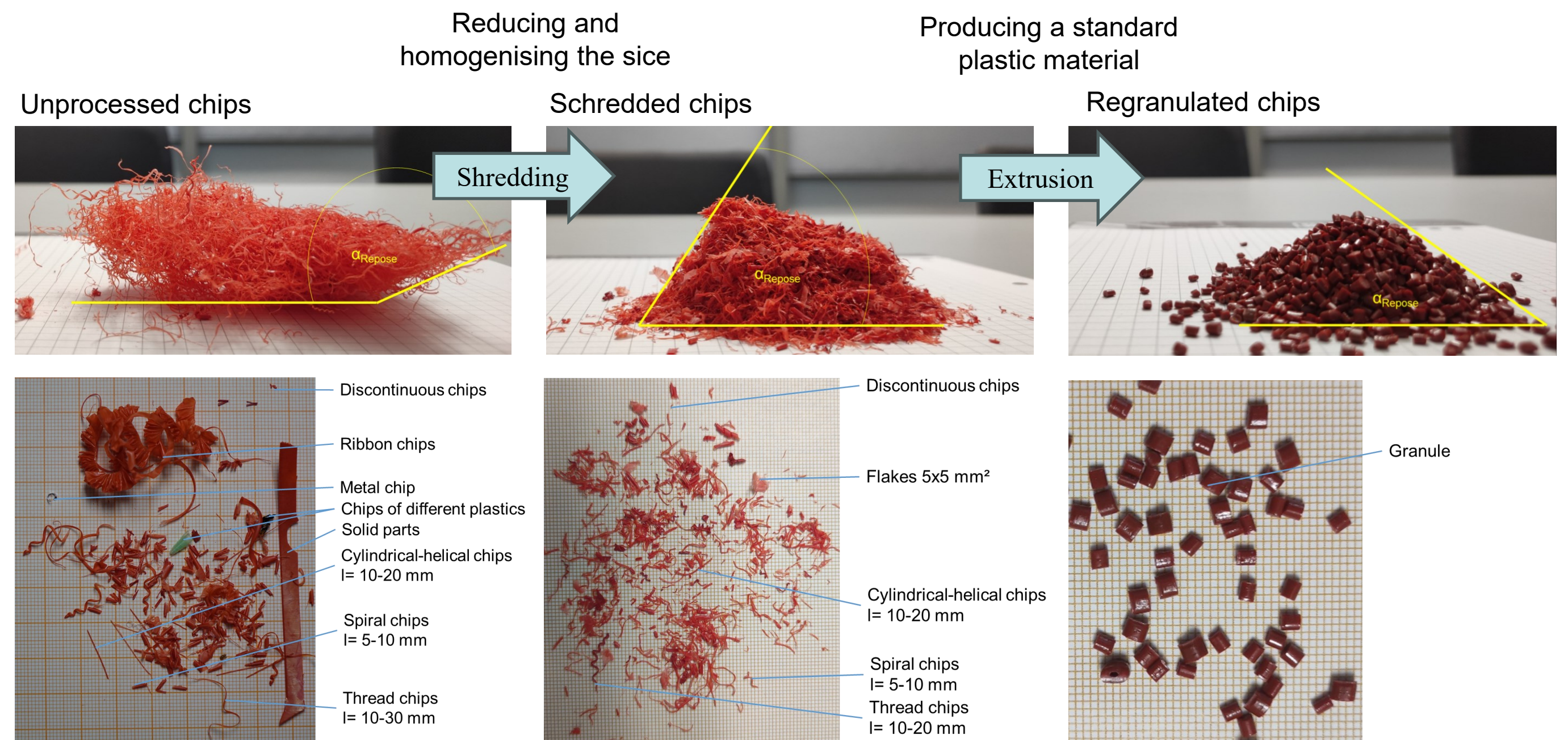
Motivation

- Use of high-end thermoplastics like PEEK for milled parts
- Amount of several 100 kg per year for each milling machine
- Local recycling chains are needed for an economical use of the material
- Many synergy effects between milling and 3D-printing

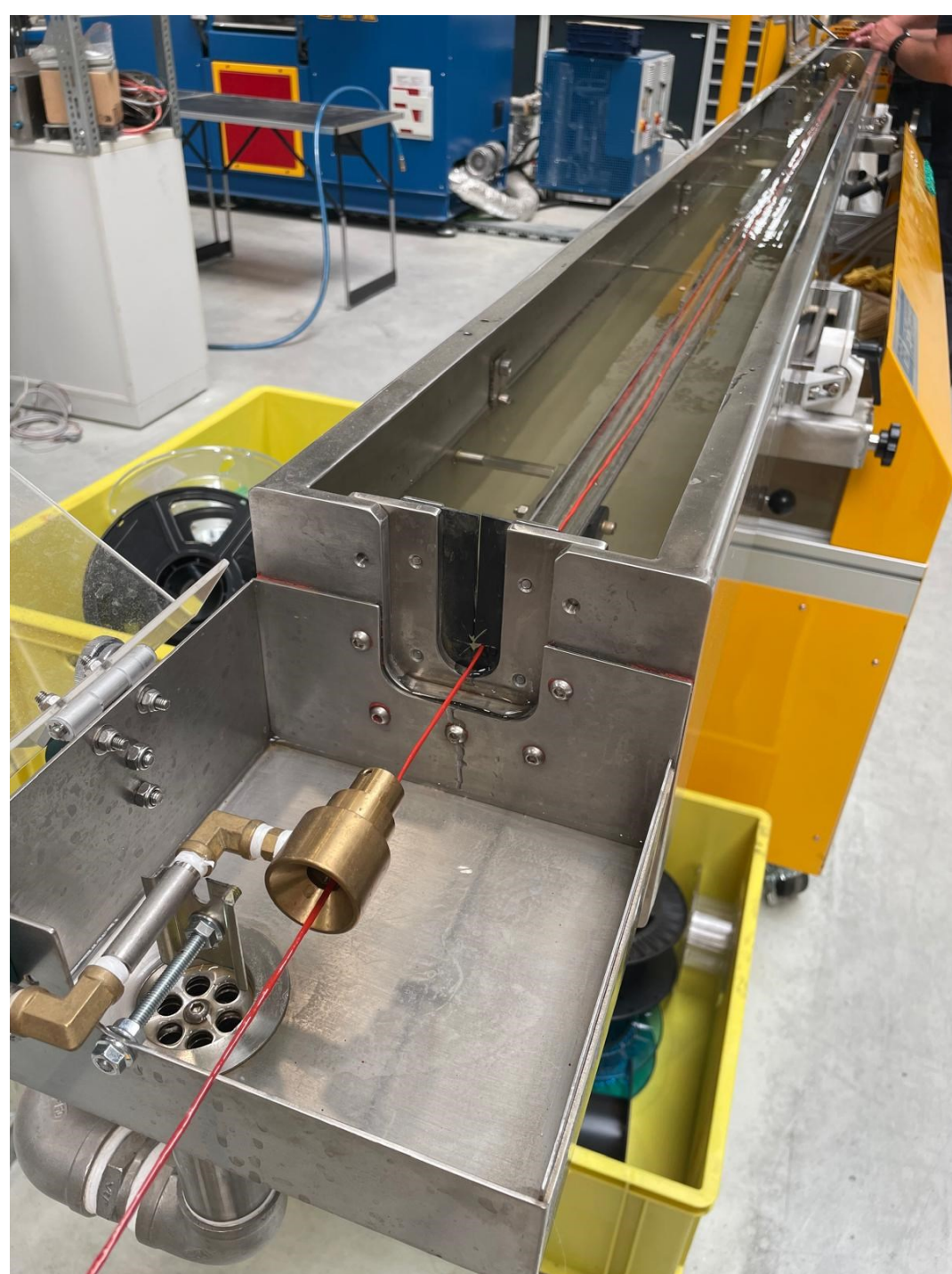
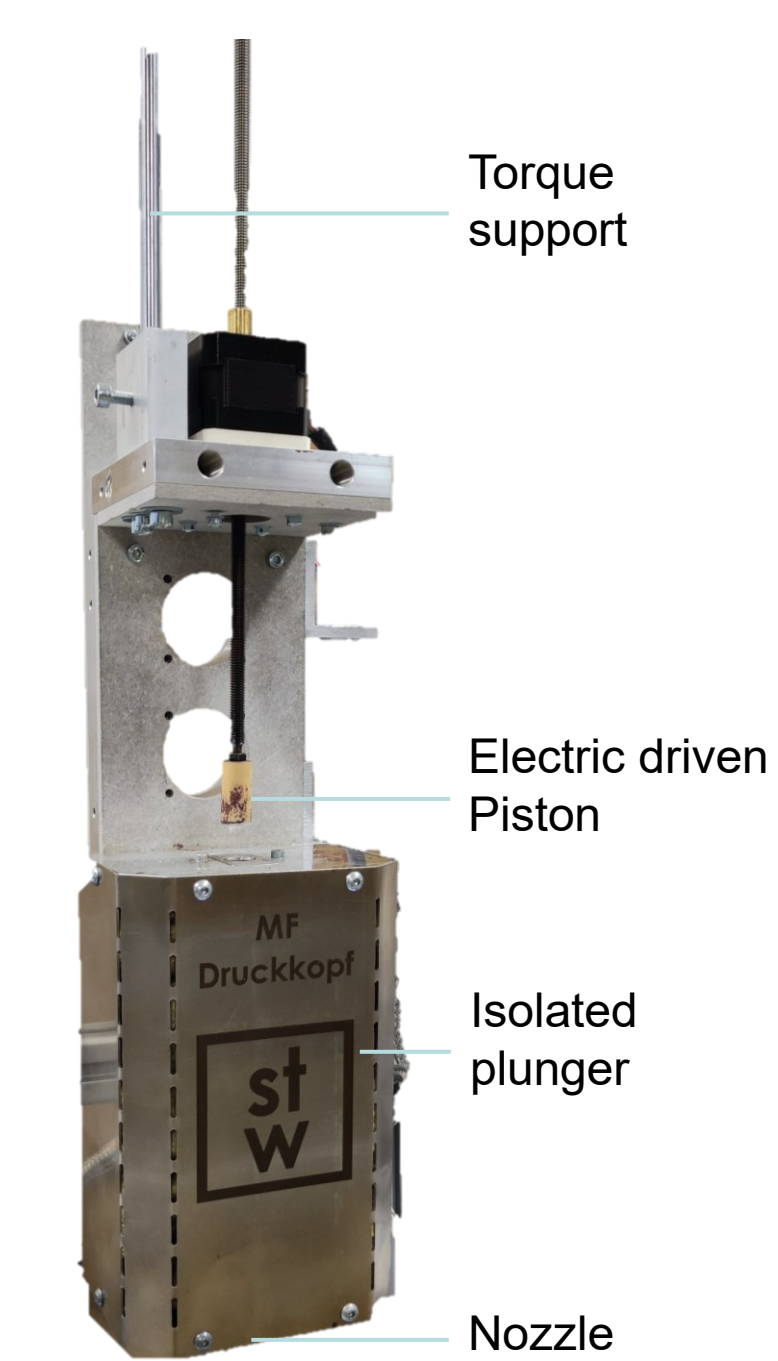
Thermo-Mechanical Processing of the Chips

Processing of the chips

- Creating an easy to handle material
- Creating a homogeneous length of the chips
- Reducing the amount of air in the material
- Removing metal and plastic pollutions from the chips
- Avoiding thermo-oxidative degradation of the material

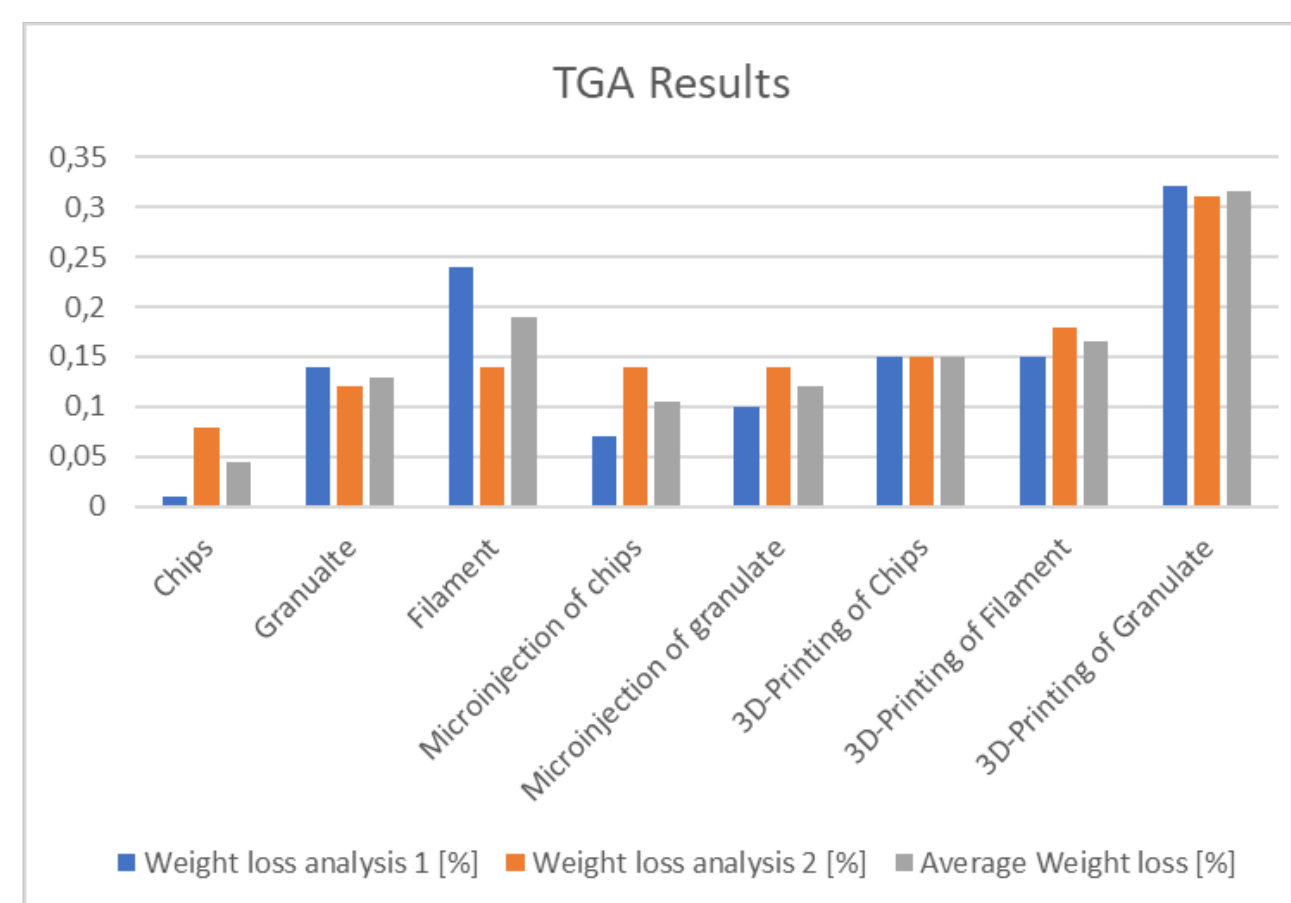
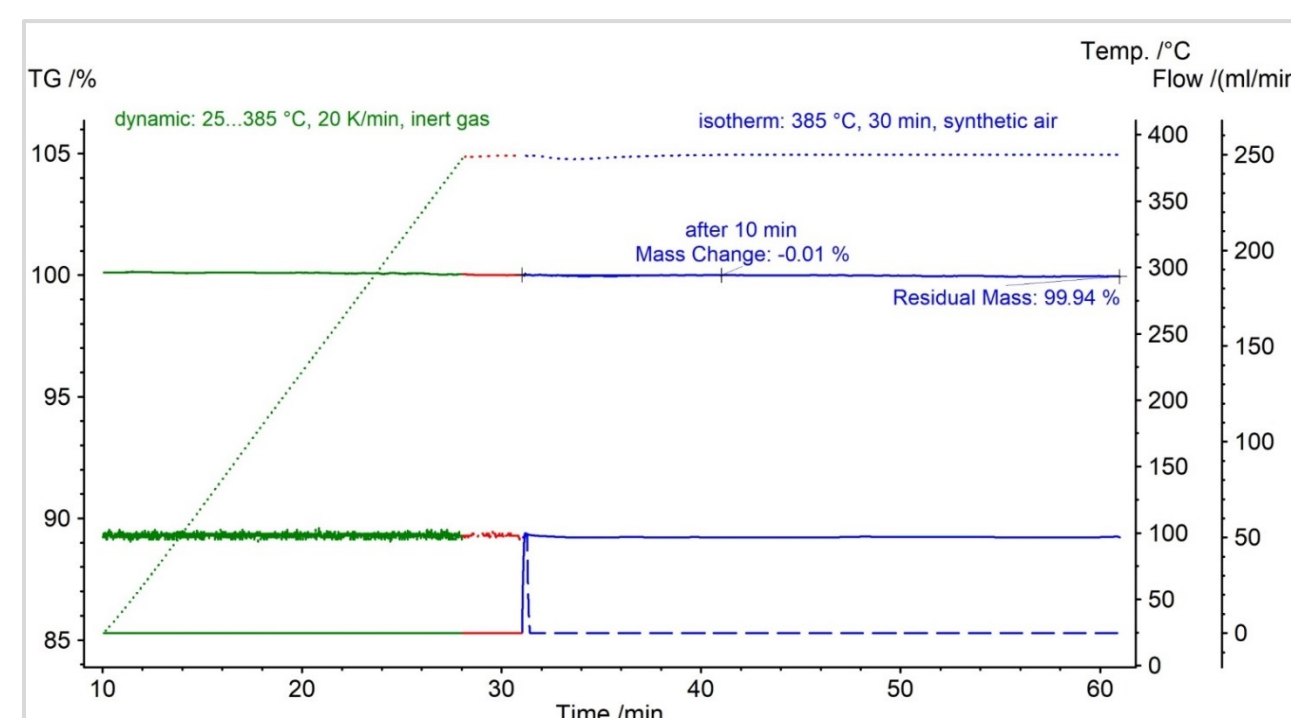


Printing Processes



Plunger-printing-head for extrusion of chips and granulates

Extrusionline for producing plastic-filaments of chips and granulates



TGA (Thermogravimetric Analysis) of unprocessed chips and TGA results of the different recycling chains

3D-Printing

- Plunger-printing-heads can process the chips and granulates
- Direct Printing from chips is possible but difficult because of the high air ratio in the material
- Pre-processing the material by filament or granulate extrusion is increasing the process quality
- Pre-processed material has a thermo-oxidative degradation
- The thermo-oxidative degradation can be detected by the weight loss in the TGA
- Filaments can be printed with compatible (high-temperature) printing heads