

Steinbeis-Innovationszentrum Automation in Leichtbauprozessen (ALP)



Werkzeugmaschinen -Service GmbH



UNIVERSITY OF TECHNOLOGY IN THE EUROPEAN CAPITAL OF CULTURE CHEMNITZ



Ein Unternehmen im Steinbeis-Verbund

# **Plastic Chips as Feedstock for 3D-Printing-Processes**

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## **Recycling Routes of Plastic Chips**



### **Thermo-Mechanical Processing of the 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

### **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**



#### **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

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

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

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<sup>■</sup> Weight loss analysis 1 [%] ■ Weight loss analysis 2 [%] ■ Average Weight loss [%]