

Amorphous Polymer Parts Produced by Powder Bed Fusion

Fraunhofer IPA developed sustainable 3D printing processes using amorphous polymer powders

As part of a feasibility study, the Fraunhofer IPA research teams are demonstrating the high potential of low-temperature processes using amorphous polymer powders, such as polycarbonate (PC) and acrylonitrile butadiene styrene (ABS), with Selective Laser Sintering (SLS) and High Speed Sintering (HSS), achieving a 100% recycling rate.

Currently, polyamide 12 and 11 account for around 90% of polymer powder bed fusion applications. To expand PBF into new fields, however, additional material classes are required. Fraunhofer IPA therefore investigated the amorphous thermoplastics polycarbonate (PC) and acrylonitrile butadiene styrene (ABS) for processing by Selective Laser Sintering (SLS, PBF-LB/P) and High Speed Sintering (HSS, PBF-IR/P).

A key challenge is the development of powders with suitable flowability, layer formation and fusion behavior. At the same time, Fraunhofer IPA aimed to establish sustainable SLS and HSS processes at significantly reduced build temperatures. In conventional processes, the powder bed is kept close to the polymer softening temperature, which can cause thermal aging of the unfused powder. Lower build temperatures can substantially reduce this degradation and enable complete reuse of the unfused material.

Processing trials were conducted on industrial-scale equipment. By optimizing laser power, scan speed and hatch distance for SLS, as well as sintering lamp speed and power for HSS, dense demonstrator parts were successfully produced at moderate build temperatures. The unfused powder showed no measurable signs of thermal aging and could be fully reused without loss of quality. The results demonstrate the potential of low-temperature SLS and HSS for recyclable amorphous thermoplastics and provide a basis for further material and process development.

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exhibit overview