166th MSS-Seminar
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Room 00.156,
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Characterization of feedstock materials for powder bed fusion Additive Manufacturing

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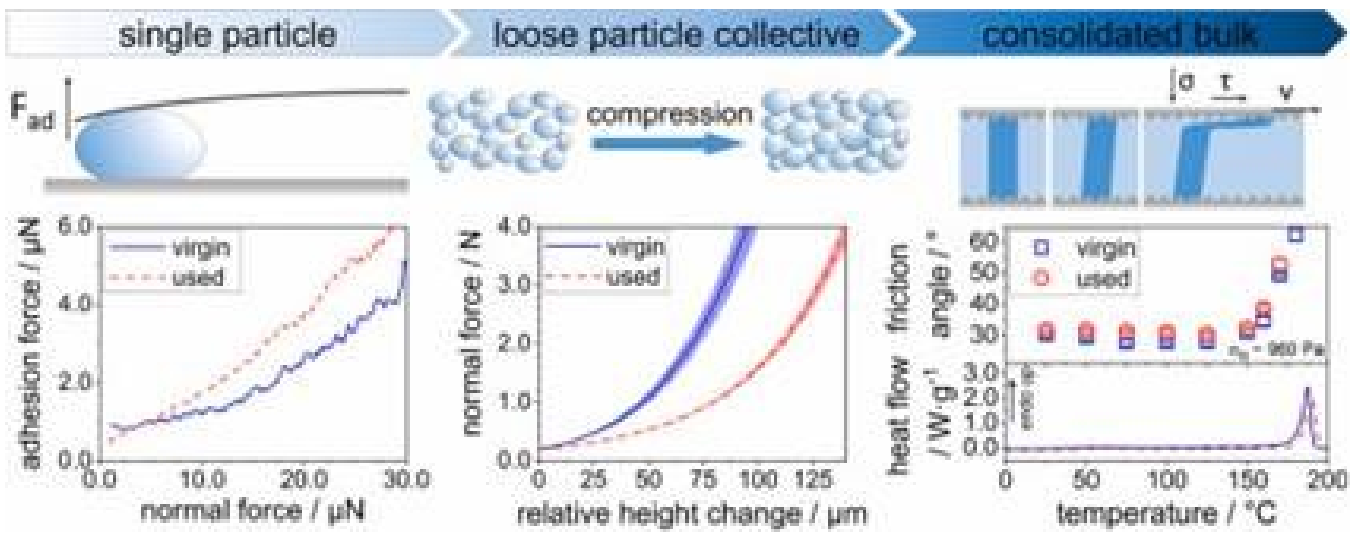
Additive manufacturing (AM) processes allow for the production of individualized components of complex geometries without the need for tools or molds. If functional AM-built components of good mechanical properties are desired, typically powder bed fusion (PBF) AM processes are employed. In case of plastic components, PBF of polymers with laser beam (PBF-LB/P) also known as (selective) laser sintering, is an established AM method, while in case of additive manufacture of metal components, PBF of metals with laser beam (PBF-LB/M) and electron beam (PBF-EB/M) are frequently used. In the aforementioned PBF-AM processes, a powder layer is spread onto the building platform within a heated build chamber and the contour of the part to be produced is selectively fused by the beam source. Then, the building platform is lowered, a new powder layer is spread and the next cross-section of the component is fused. The process sequence is repeated, until the build job is finished. The component quality is determined by the interaction of the AM machine with the feedstock powder. Moreover, the feedstock powders need to exhibit certain bulk solid characteristics, as well as appropriate thermal and rheological properties. Concerning bulk solid properties it becomes obvious from the sketched AM process sequence, that flowability and packing fraction, are the key towards successful powder spreading and preparation of a powder bed of homogeneous packing density and, thus, the reproducible manufacture of dense parts of sufficient mechanical properties and dimensional accuracy.

In this talk, powder requirements for PBF-AM processes will be addressed and established state-of-the-art methods, as well as novel approaches for characterization of bulk solid properties of AM feedstock powders under process conditions will be reviewed and assessed with respect to the method’s predictability of the feedstock’s AM processability. Moreover, some important plastic powder production and functionalization methods will be briefly sketched and the effect of particle (c.f. size distribution, shape) and bulk solid properties on part properties and processability, i.e. structure-property relationships along the AM process chain will be demonstrated for selected examples.



Hesse et al., Additive Manufacturing Vol. 41 (2021) 101957