Contribution ID: **44** Type: **not specified**

Morphological and Structural Changes of Ceramic Powders during Plasma Spraying

Powders with spherical particles are utilized in various industries such as health, food, or in additive manufacturing due to their enhanced flow properties. Plasma spray spheroidization is an effective tool for manufacturing of such powders from angular or agglomerated powder feedstocks, namely thanks to its high feedstock throughputs. In this thesis, the formation process of spherical particles in hot gases, the in-flight behaviour of the particles, and several methods of powders' characterization were described. The collection chamber for powder spheroidization using the high-enthalpy hybrid water stabilized (WSP-H) plasma torch was designed and manufactured with emphasis on maximal collection efficiency. Spheroidization experiments with Al2O3 and TiC powders were performed and the morphology, sphericity, flowability, particle size, and chemical and phase composition of resulting powders were observed. Successful spheroidization of Al2O3 enhancing its flowability without significant phase changes was achieved. In case of TiC, significant refinement and oxidation into TiO2 powder was observed.

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