High Velocity Flame Spraying of Nano-structured Materials and Related Industrial Applications

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HVSFS processing is a promising method to produce novel structural and functional coatings, by the direct processing of nano and micro ceramic suspensions in thermal spray systems. The potential of these coatings is well known and has gained vital interest among the scientific and industrial community. It is expected, that thermal spraying with liquid feedstocks will give substantial contributions in numerous industrial key applications like biomedicine, energy conversion, catalysis, automotive and aerospace. Fabrication routes and processing of solutions and suspension feedstocks containing fine primary particles strongly differ from conventional spray materials preparation. The HVSFS suspension flame spray process represents a novel process for the direct processing of nano-powder suspensions in a workplace safe closed system technology, which opens new application fields even for established materials since nanoscale coating structures can improve properties and performance compared to the respective standard coatings. Especially in case of suspensions, their preparation, storage and handling require distinct expertise. Flame interaction of liquids and suspensions with different heat and mass transfer as well as coating formation phenomena are key issues to gain the necessary process knowledge.

This is required to control the liquid feedstock based spray process and raise the technology to an industrial production and stability level. Especially in the field of thermally sprayed tribo-functional coatings, nano materials show enhanced characteristics regarding coating microstructure, porosity and surface topography as well as improved lifetime, wear and corrosion resistance. The potential of direct use of nanoscale thermal spray feedstocks as suspension will be demonstrated in various industrial applications, e. g. internal combustion engines, gear and train systems, industrial engineering and special tools.

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