New developments on suspension spraying: from hardware to coating solutions

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By using suspensions as feedstock for atmospheric plasma spraying (APS) and high velocity oxy-fuel spraying (HVOF) coatings with a wide variety of thicknesses, morphologies, and properties can be produced. The economic efficiency of the process depends not only on the development and handling of stable suspensions, but also on the availability of suitable additional system components. The symbiosis between these two important factors has allowed, over the last few years, significant advances in terms of deposition efficiency and feed rate in relation to the solid content of the suspension.

For the conventional thermal spraying process, the availability of fused feedstock powder composed of two oxides or more is limited, although for industrial applications coatings with a wide spectra of properties are needed. Suspension spraying is the key to satisfy these requirements by offering tailored compositions in the Cr$_2$O$_3$-TiO$_2$-Al$_2$O$_3$ system. Next to ZrO$_2$, the individual oxides and binary compositions in the system Cr$_2$O$_3$-TiO$_2$-Al$_2$O$_3$ are the most used ceramic materials for thermally sprayed coating solutions. Cr$_2$O$_3$ coatings are characterized by good sliding wear resistance, while Al$_2$O$_3$ coatings show excellent insulation behavior and TiO$_2$ has striking corrosion properties. Aiming to combine these properties, suspension sprayed coatings containing more than one oxide have been produced, and are promising candidates for applications in off-shore piston-rods or pump sealing seals or hydraulic cylinder rods. In this contribution, new developments on ready-to-spray suspensions with tailored composition and on industrial-suitable hardware systems for suspension spraying will be presented. The criteria for the selection of raw materials as well as aspects of the development of binary /ternary suspensions to be used in thermal spray will be discussed. Coatings sprayed using the developed suspensions and high velocity oxy fuel flame spraying (SHVOF) will be presented and analyzed in terms of their properties. From the experimental results it was observed that the suspension sprayed coatings showed in most of cases denser microstructure, higher mechanical properties and superior corrosion performances when compared to coatings produced from feedstock powder.