THE PREDICTION OF COATING MICROSTRUCTURE IN PLASMA SPRAY PROCESS

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Abstract

Plasma spray deposition is one of the most important technologies available for producing the high-performance surfaces required by modern industry. In this process, powder of the coating material is fed into high-temperature plasma, which melts and accelerates the powder; the molten particles subsequently hit and solidify on the surface to be coated. Most of the applications require coatings with a high density, which are well bonded to the substrate. To obtain good quality coating, the powder particle must be at least partially molten and hit the substrate with a high velocity.
The flattening characteristics of the droplets impinging on a substrate are important determinants in governing the eventual quality of the plasma spray coating. Because the mechanical performance of the coatings depends crucially on the particles flattening and intersplat bonding, such studies are very important to unravel the complex interaction between spray parameters and coating properties different codes have been developed in recent years to simulate the overall thermal spraying process, as well as the growth of the 3D coatings, in which entrained particles are modeled by stochastic particle models, fully coupled to the plasma flow. Similarly to previous work, there are still a lot of assumptions involved in these codes, dealing with the shape of the droplets, the degree of splattering edge curl up, the porosity of the coating, and so on.
The present investigation was carried out to have an approach to systematize the atmospheric plasma spraying process in order to create a basis for numerically modeling the plasma dynamics, the coating formation mechanisms and to predict the particle thermo- kinetic state at impact.

Keywords: plasma spray process, flattening, coating, solidification, numerical model

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