

COLD SPRAY OF AMORPHOUS, NANOCRYSTALLINE AND METASTABLE ALLOYS

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Cold spray is an emerging process used to produce coatings by means of a supersonic gas jet where solid fine powder particles are accelerated above a critical velocity at which the particles impact, plastically deform and adhere to the surface of the substrate. As opposed to other conventional spraying processes, cold spray does not involve any significant heating of the driven particles. Consequently, the resulting coating microstructure and chemical composition have been shown to match that of the original powder. In this study, nanocrystalline, amorphous and metastable microstructured powders were deposited on aluminum and steel substrates. The coating after deposition was composed of the same microstructure as observed in the feedstock powder. The observed overall deformation suggests the occurrence of localized deformation process at the particle/particle boundary and possible adiabatic deformation softening at the powder interior during splat formation. This work also demonstrates that it is possible to produce bulk near net shape deposits with the same characteristics of the feedstock powder, for example, large, fully amorphous deposits can be sprayed without the constraints existent on conventional powder metallurgy processes. The synthesis of fully amorphous, nanocrystalline or metastable microstructured porous free coatings using cold spray was demonstrated in this work.