SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS OF THERMAL SPRAYED POWDERS

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Self-propagating high-temperature synthesis (SHS) is of considerable interest for the formation of the composite materials. Principal advanteges of the SHS-technologies are shorter processing times, possible reduction in reinforcement deterioration and elimination or lowering additional energy supply from external source due to utilization of the exothermal effect of reaction of the interaction between components Moreover, since the high-temperature synthesis process can volatilize contaminants, a product with increased purity can be obtained.

This work evaluate the potential of using SHS-composite powders for thermal spraying protective coatings.

Composite powders were produced by the synthesis of one component (carbide, oxide, intermetallide) in the presence of the other, so-called "diluent", using high-temperature exothermal reaction of refractory compound formation.

SHS-technologies for producing composite materials of type "metallic binder (or intermetallide) / refractory compound (carbides, oxides)" have been developed. Next materials were used: Fe, Fe-15%Cr, Fe-30%Cr, Ni-20%Cr, Ni-40%Cr, Al, Al-12%Si as metallic binders, aluminides - NiAl, FeAl, Fe_2Al_5, carbides - TiC, Cr_3C_2, Cr_7C_3, SiC; oxides - AI_2O_3, Cr_2O_3, TiO_2.

The powder production process consists on the following stages:

- reactive mixture preparing, including mixing and, if it is necessary, thermal or mechanical activation;
- self-propagating synthesis,
- crushing and milling of the product to powder and
- powder classification

The results of structure and properties investigations for the synthesized powders and for the coatings from them are presented. All the powders produced are characterized by the fine microstructure (grain size is about 0,5-10 μm) and by uniform distribution of hard grains within materials volume.

The composite powders were sprayed using plasma (air or low pressure) and highvelocity oxygen-fuel (HVOF) methods. The spraying parameters were optimized according to deposition efficiency criteria.

In general, deposition efficiency, density and hardness of as-sprayed coatings from synthesized powders are higher than from plated or agglomerated composite powders, while the cost is cubstantially lower.

Comparative wear tests have also showed the greatest difference in wear behaviour for both adhesion and abrasion mode (including erosion by solid particles) This fact is explained by the higher cohesion bond strengh between components of the composites (due to metallic component fusing during synthesis), as well as by the fine hard grains distribution.

From the data obtained, it is evident that self-propagating high-temperature synthesis is a promising method for production of thermal sprayed composite powders. It enables inexpensive coatings with improved properties to be produced.