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Effect of thermal spray process on chemical composition, magnetic behaviour, structure and mechanical properties of coatings based on milled Fe, Co a nd Al_2O_3 powder

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Abstract: Coated steel substrate by FeCo/Al_2O_3 nanoparticle with various Co concentrations realized by a thermal spraying process, preliminary powder alloy was elaborated by mechanical alloying technique for 20 h of milling time. The aims of this work are to study the effect of thermal spraying process and mechanical alloying on chemical composition, magnetic behaviour, structure and mechanical properties of coating. After mechanical alloying, the crystallite sizes of the powder were decreased from 18 to 7 nm and the lattice strains increased from 0.36 to 0.56%. This is due to the phenomenon of diffusion of cobalt in the iron lattice and the milling effect. After thermal spraying, many different phases appeared in the coating, such as Al_2FeO_4, $CoAl_2O_4$, CoFe and $CoFe_2O_4$. Magnetic behaviour was influenced by this change in the chemical composition of coating. The maximum saturation magnetization was found in $Fe_{40}Co_{20}(Al_2O_3)_{40}$ sprayed powder, however, the minimum coercivity was found in $Fe_{50}Co_{10}(Al_2O_3)_{40}$ sprayed powder. Mchanical properties parameters such as microhardeness and Young's modulus were enhanced by the change in chemical composition during mechanical alloying and thermal spraying process.

Keywords : FeCo/Al2O3 nanoparticle coating, Mechanical Alloying, Thermal Spraying, magnetic behaviour, structural and mechanical parameters