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Abstract

In this study an iron aluminide powder with the feedstock powder composition of Fe-28Al-5Cr and a particle size of 45 µm to 75 µm was thermally sprayed onto AlSi10Mg and AlSi12CuNiMg substrates by flame spray (FS), atmospheric plasma spray (APS) and high velocity oxy-fuel spray (HVOF) processes. The combination of the utilized materials is due to lightweight design and is, therefore, different from most of the previous studies, which dealt with the application of iron aluminide coatings onto steels. Coatings were analyzed in terms of microstructural investigations using SEM coupled with EDX measurements in the as sprayed condition and after a heat treatment of 100 h at 500 °C in argon atmosphere. Phase analysis was performed by XRD measurements in the as sprayed and heat treated condition. The FS and APS coatings contained different amounts of a bcc solid solution α(Fe, Al, Cr), FeO, Fe_3O_4, $FeAl_2O_4$ and γ-Al_2O_3. It was found that the FeO rearranged to bcc Fe and Fe_3O_4 during this heat treatment. The HVOF coating retained 90 % of feedstock powder material and a low fraction of oxide and Al-depleted phases. The microhardness was determined to be 277 HV0.4 (FS), 394 HV0.4 (APS) and 479 HV0.4 (HVOF) which was associated to the different constituting phases. Adhesion strength was measured using the tensile adhesion test