

# COMPOSITION DESIGN OF Fe BASED NANOSTRUCTURED AND AMORPHOUS ALLOYS FOR HIGH PERFORMANCE CORROSION AND WEAR RESISTANT COATINGS



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Metastable processing of commercial stainless steels of different families, with modified compositions, can result in amorphous and/or nanostructured alloys with excellent wear and corrosion resistance. We report the development of B-modified super duplex, ferritic and super martensitic stainless steels, and their performance as coating materials produced by high velocity oxygen fuel (HVOF). Amorphous or partially amorphous powders from the superduplex and the ferritic stainless steels were used to produce HVOF coatings on different steel substrates. The precursors powders and coatings were characterized by X-ray diffraction (XRD), differential scanning calorimetry (DSC) and scanning (SEM) and transmission electron microscopy (TEM) and compared with alloys of the same composition processed by melt spinning. The corrosion properties were evaluated by corrosion potential survey and potentiodynamic polarization. The wear behavior of the coatings was measured with a dry sand/rubber wheel apparatus and by pin-on-disc tests. HVOF processing resulted in predominantly amorphous coatings for the duplex and ferritic alloys resulting in superior wear behavior in comparison with fully crystalline alloys of equivalent compositions. Excellent corrosion properties were observed in the amorphous ribbons and as expected the superduplex alloys with higher Cr content presented the best results in terms of corrosion resistance. Identification of phase selection and thermodynamic simulation were used to propose new compositions for the ferritic-based alloy with possible tuning of the wear and corrosion properties. A supermartensitic stainless steel was also modified with the addition of small boron contents and processed by spray forming, to develop functionalized stainless steel with higher wear resistance. The metastable processing and the microstructural modifications due to B addition in the designed stainless steels compositions are discussed in association with the wear and corrosion properties.

Walter Jose Botta Filho is currently a professor in the Materials Engineering Department at the Federal University de São Carlos in São Carlos, Brazil. He received his BSc in Materials Engineering at the Federal University of São Carlos, his MSc in Metallurgy at the University of São Paulo, and his Ph.D. from the University of Oxford in 1985. His current research involves processing and characterization of amorphous, metastable and nanostructured metallic alloys. Since 2010, he has been Editor-in-Chief of *Materials Research - Ibero-American Journal of Materials*.