MICROSTRUCTURE FORMATION AND WEAR RESISTANCE OF SPRAY FORMED DUPLEX STEELS CONTAINING BORON

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The microstructure formation and abrasive wear resistance of spray formed duplex steels with boron modifications were investigated. Two different boron contents were studied: 0.8 wt.% (hypoeutectic) and 2.5 wt.% (hypereutectic), which led to different solidification paths. Thermodynamic calculations were carried out to explain the observed microstructures that were composed of an austenitic-ferritic matrix surrounded by boride particles. In the case of 0.8 wt.% B, borides of M_2B-type were formed, whereas for 2.5 wt.% B an additional formation of M_3B_2-type could be observed in addition to M_2B. According to the isopleth diagram of Fe-Cr-Ni-Mo and B, for boron contents >1 wt.%, the formation of M_2B as primary phase should take place. In general, a good correlation between thermodynamic calculations and spray formed microstructures was found, which indicates that solidification in spray forming occurred in near-equilibrium conditions. The abrasive wear resistance was investigated with the dry sand/rubber wheel test. The results indicated a good performance of boron-modified duplex steels comparable to the cobalt-based Stellite 1016 alloy. The improved wear resistance could be attributed to the high volume fraction of boride particles in the order of 35% that increased the hardness of the duplex steel and effectively shielded the austenitic-ferritic matrix from abrasion.