Development of Highly Wear Resistant Iron Based PTAW Hardfacing Alloys

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ABSTRACT

Typically, highly wear resistant PTA materials for mining and mineral processing applications are developed by adding ceramics like tungsten carbide to appropriate matrices. The problem is that failure during abrasion can often occur as a result of preferential wearing of the soft matrix material or crack formation through the highly loaded brittle ceramic phases. In this paper, the development of new highly wear resistant plasma transferred arc (PTAW) iron based alloys will be detailed. In this case, the matrix material itself was found to have excellent abrasion resistance with high hardness obtained in the weld deposits up to R_c 66 from the development of a fine structure consisting of a high volume fraction of complex $M_{23}(BC)_6$ and $M_7(CB)_3$ borocarbides phases. The matrix material is found to additionally exhibit high toughness up to 73.3 $MPam^{1/2}$ due to an effective distribution of fine carbide and boride phases in a ductile dendrites / cells. When adding WC particles to the starting powder and welding, the matrix was found to effectively wet the WC particles forming a strong tough matrix which avoids the typical “pull-out” or cracking found in conventional PTAW hardfacing materials. Specific weight loss measurements were conducted using ASTM G-65 wear testing and will be correlated to the structure achieved during PTAW.