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Original Research Article

Exploration of the microstructures of two series of chromium–rich Mn–based alloys elaborated by casting

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ABSTRACT

Manganese is a rather abundant element on earth and alloys based on it may be unexpensive. Alloyed with chromium for corrosion resistance and with carbon and a strong carbide-former element Mn can be the base of new metallic materials with interesting properties. In this work it is aimed to try elaborating Mn-based alloys by foundry and, in case of successful results, to explore the obtained microstructures. Two series were considered, a first one of the Mn – 25wt.%Cr basis with increasing amount in carbon, and a second one with addition of both carbon and tantalum addition. These seven alloys were synthesized by high frequency induction melting and their microstructures were examined using electron microscopy. Thermodynamic calculations were carried out to better understand the microstructure formation. Results show that a double-phased matrix composed of two intermetallic compounds was obtained for all alloys, as well as chromium or tantalum carbides as soon as the carbon content was high enough. Cutting was hard and led to microcracks revealing lacks in toughness. The hardness is very high. It is concluded that the elaboration of such alloys by foundry pose some problems which must be solved, but is possible. The high hardness can be interesting for some applications but the toughness is to be improved. Outlooks of this work are the characterization of the corrosion behavior of these alloys and of their mechanical properties.

Keywords: Manganese-based alloys; carbon; chromium; tantalum; foundry; microstructures; hardness