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New wear resistant cast alloys for use at elevated temperatures

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Abstract. Composite cast rolls for hot rolling applications mostly consist of a ductile cast iron core and a wear resistant layer material. Due to severe abrasive wear at high temperatures the shell material has to meet special demands regarding hot strength of the matrix and the amount and distribution of wear resistant carbides. New alloys with higher contents of carbon, niobium, vanadium and cobalt were developed to meet the new challenges. Higher carbide contents, with a focus on hard MC-type carbides, with a uniform distribution in a hot strengthened matrix were the main aims of the development. Based on equilibrium calculations the microstructures, which develop from the melt, are analysed and the results discussed with respect to the matrix and carbide composition as well as content and distribution of the hard phases.

Different alloying systems, containing different amounts and combinations of the above mentioned elements as well as different, tailored heat treatment procedures for microstructure optimisation were investigated to improve the material´s properties in the hardened and tempered condition. Important characteristics for the materials were obtained in a row of laboratory investigations as high-temperature micro-indentation of the matrix material, distribution and content analysis of carbides as well as macro-hardness testing, fracture toughness and fatigue tests. Wear tests, both at room-temperature and at elevated temperatures of up to 550°C, were part of the analysis of the alloys.

This paper presents the results of investigations concerning as cast microstructures and gives a comparison between newly developed materials and a standard high speed steel grade M3. The focus is on the wear resistance at elevated temperatures and the material´s properties that have an influence on those.

Keywords: *Wear resistance, high temperature micro-indentation, MC carbide, elevated service temperature, mechanical properties*