HIGH TEMPERATURE PROPERTIES OF SEVERAL FAMILIES OF TiC-REINFORCED CAST SUPERALLOYS

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Some poly-crystalline superalloys synthesized by classical foundry can be very refractory and offer unexpectedly high properties at elevated temperature. This is for example the case of some cobalt-based alloys strengthened by tantalum carbides or hafnium carbides. Besides, cast alloys based on Co, Ni or Fe, and containing other types of MC carbides may be also envisaged for high temperature applications. In this study this is the titanium carbide phase which is under consideration.

Several Ni-based, Co-based and Fe-based alloys of the \{M-25Cr-xC-yTi\} -type (x=0.25 or 0.50, y=1 or 2, in wt.%) were synthesized by casting using a high frequency induction furnace under pure argon. Their microstructures were characterized by electron microscopy and energy dispersion spectrometry. Especially prepared samples were subjected to DTA control of the melting range, to \{1200°C, 20MPa\} flexural creep tests and to oxidation in synthetic air at 1200°C. The as-cast microstructures are composed of equi-axed dendrites of matrix and of eutectic script-like TiC carbides, mixed with matrix, placed in the interdendritic spaces. The obtained temperatures of melting start are generally higher than 1300°C. The high temperature creep resistance and the behavior in oxidation by air both strongly depend on the base element. At 1200°C the best mechanical properties were obtained for the cobalt-based alloys and the best oxidation resistance was obtained for the nickel-based ones.

Figure 1 – as-cast microstructure of one of the studied alloys (here: a Co-based one); SEM/BSE micrograph