HIGH TEMPERATURE BEHAVIOUR OF CHROMIUM-NICKEL ALLOYS WITH NI VARYING FROM 50 TO 0WT.%

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Chromium is widely used in superalloys, as alloying element able to improve their high temperature mechanical behavior by forming strengthening carbides and to enhance their resistance against oxidation by gases and corrosion by aggressive molten substances. Thanks to its particularly high melting point, chromium can also be considered as base element for a next generation of high temperature alloys, and lead to Cr-based alloys able to be competitors for the best cobalt-based and nickel-based superalloys for particularly elevated temperatures. Unfortunately, despite its high melting point Cr is mechanically rather weak at high temperature and alloying is necessary to improve its mechanical properties as well as its tendency to brittleness at room temperature.

In this work nickel was chosen as primary alloying element for chromium to try reinforcing it at high temperature. A series of Cr-xNi (x=50wt.% to) alloys were synthesized by foundry and exposed to 1200°C in air. Their as-cast microstructures (SEM/BSE) and room temperature hardness (Vickers indentation) were characterized and interpreted by regards to the Ni content. The evolution of their microstructures at high temperature as well as their oxidized surface states (SEM/SE and BSE, XRD), were also specified. The as-cast microstructures were double-phased for most alloys and the hardness evolution versus the Ni content followed a bell-shape. The microstructures significantly evolved during the high temperature stage while oxidation induced microstructure change in the sub-surfaces. Chormia formed exclusively on surface but was lost by spallation during cooling in most cases. Nitridation also occurred for some of the alloys.

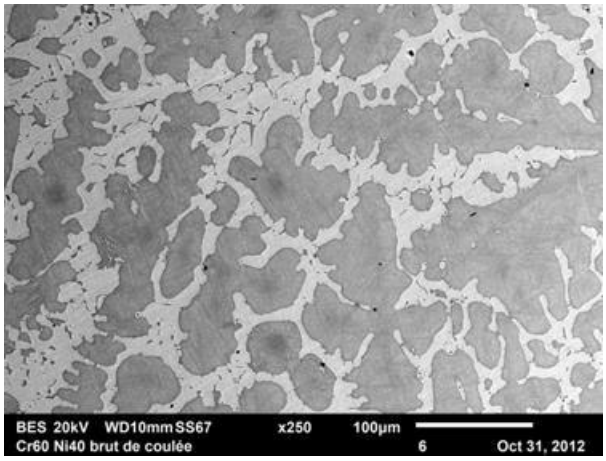

Figure 1– As-cast microstructures of one of the cast Cr-Ni alloys (SEM/BSE)