



Behaviour in high temperature oxidation of chromium-rich cobalt alloys reinforced by different types of MC carbides

Patrice Berthod, Grégory Michel, Lionel Aranda

► To cite this version:

Patrice Berthod, Grégory Michel, Lionel Aranda. Behaviour in high temperature oxidation of chromium-rich cobalt alloys reinforced by different types of MC carbides. Eurocorr 2010, Sep 2010, Moscou, Russia. . hal-03720541

HAL Id: hal-03720541

<https://hal.science/hal-03720541>

Submitted on 12 Jul 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

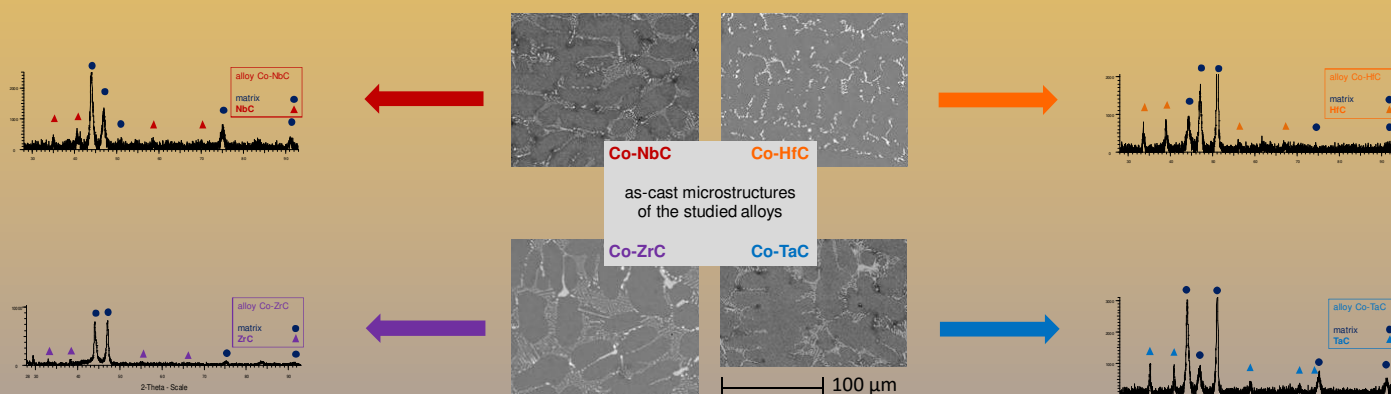
L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

In the family of MC carbides able to mechanically reinforce cast cobalt-base superalloys the tantalum carbides TaC are certainly among the most known and the most used. However the NbC, HfC and ZrC carbides can be also obtained in such alloys, and it can be interesting to explore the high temperature behaviours of alloys containing such MC carbides.

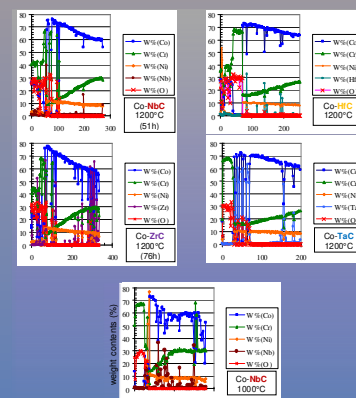
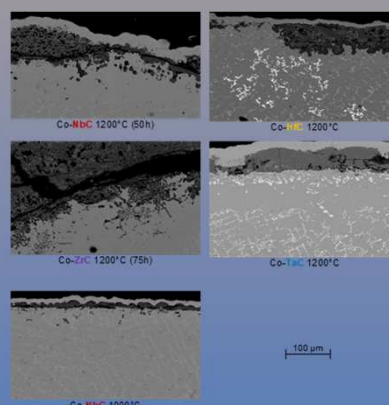
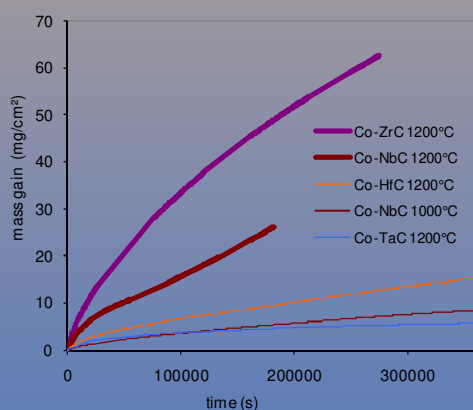
In this study several alloys, all based on Co-8Ni-30Cr-0,2 or 0,4C (wt.%), and containing quantities of Nb, Hf or Zr which allow obtaining the same carbides densities, were synthesized by high frequency induction melting, and compared to a similar TaC-containing alloy concerning both their high temperature stability and their oxidation kinetic in hot air.

Elaboration of the alloys by HF foundry under inert atmosphere

elements alloys	Co	Ni (wt.%)	Cr (wt.%)	C (wt.%)	M (wt.%)
Co-NbC	Bal.	8.3	29.2	0.39	4.6 Nb
Co-HfC	Bal.	8.5	30.2	0.46	2.6 Hf
Co-ZrC	Bal.	8.7	29.8	0.21	4.9 Zr
Co-Ta	Bal.	9.8	29.5	0.42	7.2 Ta



Characterization of the H.T. oxidation in air by thermogravimetry



The as-cast alloys display NbC, HfC or ZrC carbides forming an interdendritic eutectic with matrix, as usually observed for the TaC carbides obtained in some tantalum containing superalloys. The repartition as well as the "script" morphologies of these carbides, favorable to high strength at high temperature, are similar to the TaC-strengthened alloy with about the same [Ni, Cr, C] composition.

It is unfortunately not the case for their behaviour in oxidation at high temperature. Indeed, when oxidized at 1200°C, their mass gains are much faster and, after several tens hours, these (Nb, Hf or Zr)C-containing alloys are significantly deteriorated and the oxidation products formed on their surface are essentially spinel oxides rather than protective chromia as observed for the TaC-strengthened alloy. To take benefit of the strengthening potential of such unusual carbides a protection against hot oxidation is required.