HIGH TEMPERATURE TENSILE PROPERTIES OF β-γ-γ'-MCrAlY And β-Ni(Al,Pt) BOND-COATINGS AND INTERDIFFUSION ZONE WITH NI-BASED SINGLE CRYSTAL SUPERALLOYS

Damien Texier, Institut Clément Ader (ICA) – UMR CNRS 5312, Toulouse, France
damien.texier@mines-albi.fr
Eric Andrieu, CIRIMAT – UMR CNRS 5085, Toulouse, France
Serge Selezneff, SAFRAN Aircraft Engines, Moissy-Cramayel, France
Arnaud Longuet, SAFRAN Aircraft Engines, Moissy-Cramayel, France
Fabrice Crabos, SAFRAN Helicopter Engines, Bordes, France
Daniel Monceau, CIRIMAT – UMR CNRS 5085, Toulouse, France

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MCrAlY overlay coatings and Pt-modified aluminide diffusion coatings are commonly used in thermal barrier coating (TBC) systems for turbine blade and vane applications. Purposely designed for oxidation and corrosion protection, MCrAlY and aluminide coatings have a ductile-to-brittle transition temperature (DBTT) of about 600 to 800°C, *i.e.* in the temperature range of service conditions. Therefore, these coatings can be a source of premature crack initiation under thermomechanical loading at low/intermediate temperature. They also creep at high temperature. This drastic change in local mechanical properties significantly impair the structural integrity of such multi-layered materials. Current damage-tolerant design of TBC systems preferentially deals with DBTT than with the effective temperature- and time-dependent mechanical properties of the individual layers constituting the TBC systems. Data on high temperature properties of the bond-coatings and the interdiffusion zone with the substrate are lacking. Indeed, these local properties are particularly difficult to assess up to 1100°C, both using freestanding-layer[1-4] or multi-layer specimen approaches[5]. Improvements in the prediction of the mechanical behavior and the lifetime of TBC systems require the understanding and the quantification of such local mechanical properties.

In the present study, the tensile properties of thin freestanding MCrAlY overlay coatings and Pt-modified aluminide diffusion coating specimens were investigated in a large range of temperatures, representative of service conditions. Freestanding specimens were both extracted and tensile tested for the bond-coating itself, but also for the interdiffusion zone and the substrate in order to document the gradient of properties within the TBC systems. The ductile-to-brittle transition behavior was shown and a significant ductility was evidenced for both the bond-coatings above the DBTT (*Figure **1***). The interdiffusion zone exhibited intermediate properties between those of the bond-coating and the substrate.

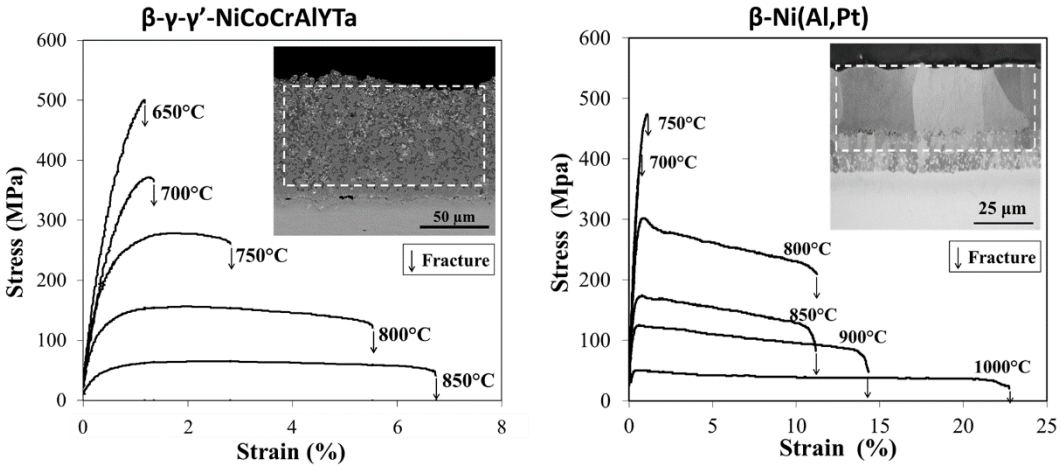

Figure 1 – High temperature tensile properties of freestanding MCrAlY overlay coating and Pt-modified aluminide diffusion coating specimens

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