

High Temperature Oxidation of INCONEL 600

Introduction

High temperature, corrosion resistant superalloys need to be characterized in terms of their oxidation kinetics. Thermogravimetric analysis (TGA) is the perfect tool for tool to get the full picture of the oxidation behavior. These characterizations require the TGA instrument to provide a good gas-solid interface, a high mass signal stability over long periods of time and a efficient control of the sample atmosphere . These requirements are met by the THEMYS TGA.

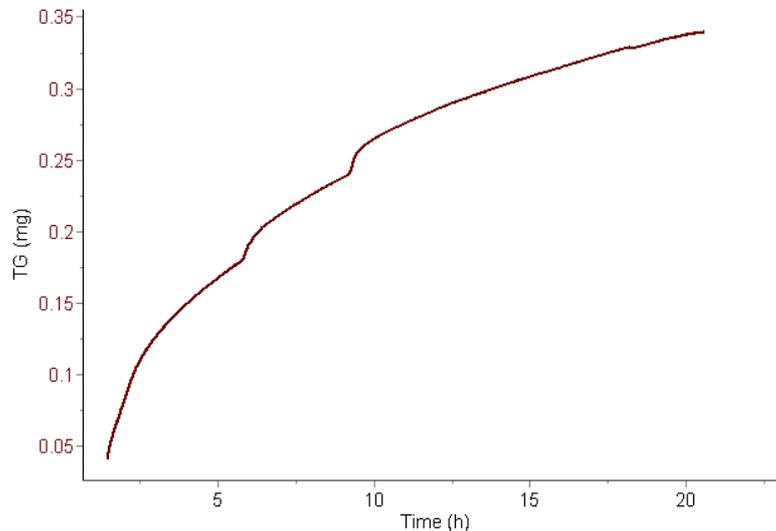


Figure 1 – INCONEL 600 sample mass increase with time due to oxidation at 900 °C

Experimental

A 53.43 mg and 75.6 mm² INCONEL 600 sample was directly hung at the THEMYS TGA suspensions so that it was centered in the TGA furnace. The THEMYS TGA was equipped with the High Sensitivity balance.

The sample was heated up to 900 °C at 10 °C/min under a flow of nitrogen. At 900 °C, nitrogen was switched to oxygen at a flow rate of 20 ml/min during 20 hours. The TG signal, or mass uptake due to oxidation was measured from that point.

Results and conclusions

Figure 1 shows the mass uptake signal over time during the 20 hours isothermal sequence. The total mass gain of the sample was no more than 298.5 µg, i.e. 0.395 mg/cm². It demonstrate the ability of the TGA instrument to measure small effect over time thanks to the combination of its high sensitivity and stability.

The bumps on the mass uptake curve at about 6 and 10 hours are linked with the formation of cracks in the oxide layer resulting in the exposure of new metallic surface and leading to sudden increase of the oxidation rate. A continuous signal as it is provided by TGA is required to detect such subtle changes in the material behavior.

The excellent signal stability and the possibility to hang samples directly in the furnace without using crucibles as it is possible with THEMYS is beneficial for such applications.

THEMYS
RT to 1750 °C



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