EVALUATION OF THE INCONEL 718 IN CREEP TEST

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ABSTRACT

A superalloy is an alloy developed for elevated temperature service, where relatively severe mechanical stressing is encountered, and where high surface stability is frequently required. High temperature deformation of Ni-base superalloys is very important since the blades and discs of aeroengine turbine, because need to work at elevated temperature for an expected long period. The nickel-base alloy Inconel 718 has being investigated because it is one of the most widely used superalloys. This alloy is also competitively priced due to the fact that the alloy contains no cobalt and has a relatively high content of iron. The objective of this work was to evaluate the creep behavior of the Inconel 718 focusing on the determination of the experimental parameters related to the primary and secondary creep states. Constant load creep tests were conducted with at 650 and 700°C. Samples with a gage length of 18.5 mm and a diameter of 3.0 mm were used for all tests. The creep tests were performed according to ASTM E139 standard.

EXPERIMENTAL PROCEDURE

Superalloy Inconel 718 used in this work was provided for the Company Villares S.A. (Sumaré-SP). The material was melting in furnace VIM, remelting in furnace VAR, after was done a heat treatment of homogenization, hot forging plain open die for drafting, hot rolling for drafting and hot rolling finish. Table 1 shows the composition of superalloy Inconel 718.
In this work, it was used an Inconel 718 alloy in the form of cylindrical bars, made by Company ENEFER Ltda.

Figure 1 – Creep test machine

Table 1 - Chemical compositions (%weight) of superalloy Inconel 718

Chemical element	C	S	Mn	Co	Cr	Ni	Nb	Al	Ti	Mo
(%)	0,042	0,0028	0,01	0,02	18,56	52,97	5,61	0,07	1,95	2,63

RESULTS

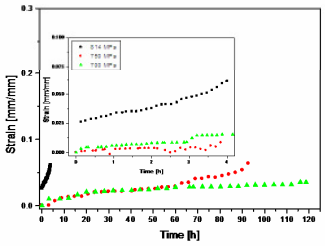

Figure 2 – Creep curves of superalloy Inconel 718 without heat treatment (conditions at 650 °C for load 700, 750 and 814 MPa.

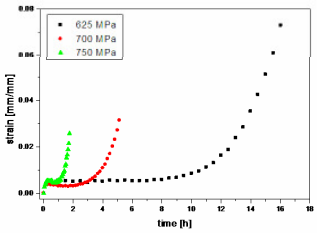

Figure 3 – Creep curves of superalloy Inconel 718 without heat treatment (conditions at 700 °C for load 625, 700 and 750 MPa.

Table 2 – Creep test at 650 °C

σ (MPa)	t_p (h)	$\dot{\varepsilon}_s$ (1/h)	t_f (h)	ε_f (mm/mm)	AR (%)
700	16	0,00013	-------	----------	-----
750	6	0,00032	92,7	0,06036	5,57
814	0,25	0,00616	4	0,06120	6,23

Table 3 – Creep test at 700 °C

σ (MPa)	t_p (h)	$\dot{\varepsilon}_s$ (1/h)	t_f (h)	ε_f (mm/mm)	AR (%)
625	1,50	0,0002	15,0	0,0511	7,23
700	0,33	0,0009	5,1	0,0314	3,80
750	0,05	0,0016	1,7	0,0258	4,23

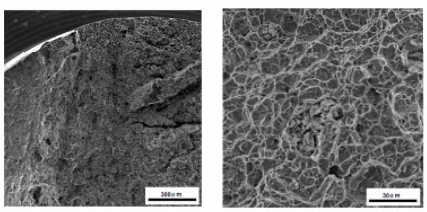

Figure 4 – Analysis fracture at 650°C for 750MPa

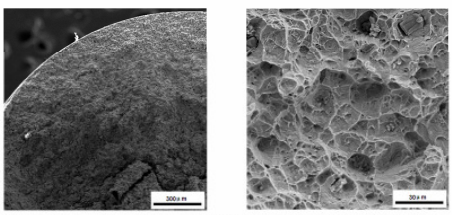

Figure 5 – Analysis fracture at 700°C for 750MPa

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