Development of a creep testing machine with the maximum temperature 1000℃ for utilizing miniature specimens and evaluation of creep strength for IN713C-MIM

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In the current study the development of a creep testing machine with a maximum temperature 1000 degrees for utilizing miniature specimens and evaluation of creep strength for IN713C-MIM were conducted. The remaining creep life could be predicted by destructive evaluation method with high accuracy. The method is that a specimen sampled from the actual high temperature machine is tested under on a stress level which is identical to the actual loading. However, when sampling from the actual high temperature machine with large size, which will damage the actual machine and the sampling component cannot be reused. The remaining creep life assessment of actual devices using the miniature specimens is expected as the better method because it can decrease the damage to sampling component. Moreover, the creep strength of MIM materials is lower than that of cast or forged materials. A few studies focus on investigating creep strength of MIM materials, it is necessary to survey the creep behavior of the materials.

This research aims at solving the abovementioned needs and developing a superalloy with excellent creep-strength.

Fig.1 shows a schematic diagram of the developed test equipment. This is capable of creep testing in air with a maximum temperature of 1200℃ and a maximum load of 200kgf. The loading mode is axial loading type.Fig.2 show the shape and dimension of specimen used in this study. Creep tests were performed on the IN713C-MIM material at 982℃ and 40MPa.The tested results are rupture time of 3.5h, creep strain of 23 %, minimum strain rate of 1.7 %/h. It is suggested that the test equipment can measure rupture time, creep strain and minimum strain rate. However, more detailed evaluating of the strength is also necessary.

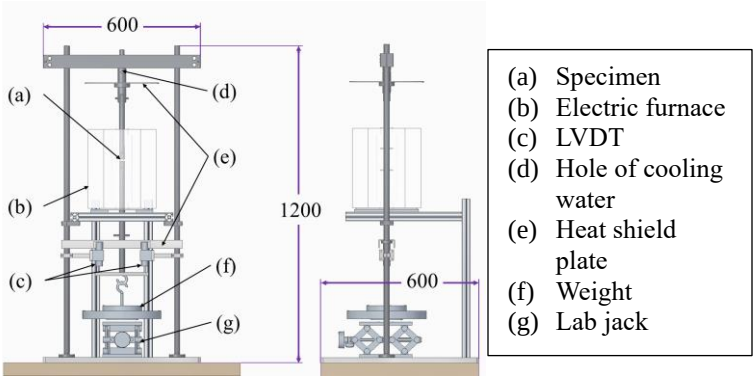

Fig.1 Schematic showing of creep testing machine (mm).

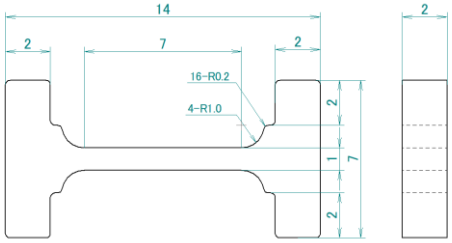

Fig.2 Shape and dimensions of specimen (mm).

1) Hideyuki KANAYAMA, HIYOSH, Fumio OGAWA, Mie KAWABATA, Takamoto ITOH, Takashi WAKAI, *Journal of the Society of Material Science*, *2019, 68*, *421.*
2) Shinya HIBINO, Kazushige FUJIMITSU, Ryutaro OKADA, Yoshimichi NOMURA, Kenichiroh IGASHIRA, *Japan Society of Powder and Powder Metallurgy*,*2019, 66, 17.*