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"Development of electric potential technique to identify contact area induced by a high-temperature indentation test"

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Abstract

In order to predict remaining life of aged thermal power plant, a small sample extracted from those components is usually tested. However, the repair for such shaved part is required, which could bring about any damage for the power plant. Our group has developed a high-temperature indentation test instead of a tensile test utilizing the small sample. This technique has a benefit to be able to estimate directly a high-temperature mechanical property in a local area of the aged component. In the device developed here, the impression was needed to observe by optical microscope (OM), for instance, to identify the contact area which is utilized to evaluate mechanical property. In this study, electric potential technique was developed to monitor the contact area during indentation test. In this technique, an electrode was attached to both indentation rod and sample in order to measure change in voltage under a constant electric current. Then, the voltage change, that is electric potential, is connected to extension of contact area.

Fig.1 shows the in-situ monitoring indentation device which was developed in this study. In the developed device, the indentation load is enforced by a small ball onto the small-plated sample. The indentation part is surrounded completely by an electric furnace which can heat up to 1273K. The electrode is also set at indentation rod and sample basement. In this study, a high-Cr ferritic heat resistance steel was chosen as the sample.

Fig.2 shows the yield stress estimated by our in-situ monitoring technique. It was found that the estimated results coincides with one obtained from a tensile test. As future work, we will apply this monitoring technique to estimate creep constitutive equation as Norton's law.

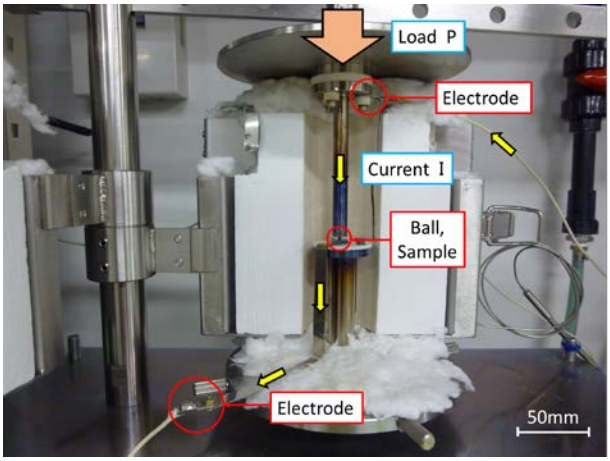

Fig.1 In-situ monitoring indentation device

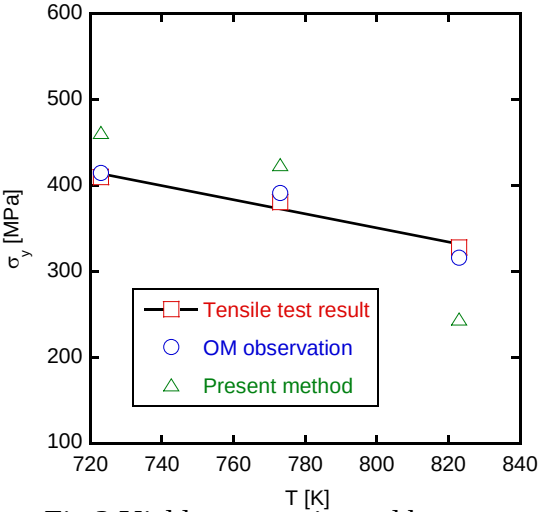

Fig.2 Yield stress estimated by our electric potential monitoring technique