ASSESSING THE HIGH TEMPERATURE PERFORMANCE OF REFRACTORY METAL ALLOYS

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There is considerable interest in new materials with higher temperature capabilities to improve cycle efficiency and thereby reduce fuel consumption and greenhouse gas emissions. A current US DOE program (ULTIMATE) is funding projects to develop refractory metal based materials for ≥1300°C operation. As part of the program, ORNL is leading a test facility to assess these new materials including 1300°C creep testing at 200 MPa in vacuum or inert environments for up to 100 h. One of the long term performance challenges for these materials is retaining ductility. With or without a coating, it is necessary to quickly and efficiently assess both oxidation rates and post-exposure mechanical properties often with small volumes of material. Using subsize (e.g. 25mm long) dogbone tensile specimens, it is possible to assess both reaction rates in a variety of environments and residual tensile and creep properties after high temperature exposures. By testing in an inert environment, the mechanical properties can be individually assessed. Initial efforts are assessing the effect of argon oxygen content on the 1300°C creep properties of conventional Nb alloys in order to standardize the test procedure for the program.

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Research sponsored by the U. S. Department of Energy, ARPA-E ULTIMATE Program.