

## **MATERIALS I: STRESS & DEFORMATION (EAST MADRONE)**

### **HIGH-TEMPERATURE DEFORMATION OF ALLOY EP-823 FOR TRANSMUTATION APPLICATIONS**

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The objective of this work is to evaluate the elevated temperature tensile properties of Alloy EP-823, a leading target material for accelerator-driven waste transmutation applications. The test material was thermally treated prior to the evaluation of tensile properties at temperatures relevant to the transmutation applications. Three experimental heats of martensitic Alloy EP-823 were melted and processed into round bars at the Timken Research Laboratory (TRL). The sectioned bars were austenitized at 1010°C for one hour, followed by an oil-quench. These oil-quenched bars were subsequently tempered at 621°C for 1.25, 1.75 and 2.25 hours, respectively, followed by air-cooling to a measured hardness that ranged between  $R_c$  29 and 30. Cylindrical smooth tensile specimens were machined from these heat-treated bars with the gage section parallel to the longitudinal rolling direction. Tensile testing was performed at temperatures ranging from ambient to 540°C using ASTM Standard E8 in the presence of pure nitrogen gas inside the heating chamber. The microstructures of broken test specimens were analyzed by standard metallographic methods. SEM was used to determine the morphology (ductile versus brittle) and the extent of failure in each specimen. TEM was used to characterize the distribution and nature of dislocations and other imperfections, so that the precise deformation mechanisms for Alloy EP-823 can be established as functions of thermal treatments and testing temperatures. Understanding deformation mechanisms of Alloy EP-823 may help the development of suitable target materials possessing enhanced LBE corrosion resistance and acceptable radiation damage.