7.1 Microstructural Stability and Mechanical Behavior of FeMnNiCr High Entropy Alloy Under Ion Irradiation — N. A. P. K. Kumar[1,2], K. J. Leonard[1], H. Bei[1], Y. Zhang[1,2] and S. J. Zinkle[1] *(Oak Ridge National Laboratory[1], University of Tennessee[2])*

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In recent years, high entropy alloys (HEAs) have attracted significant attention due to their excellent mechanical properties and good corrosion resistance, making them potential candidates for high temperature fusion structural applications. However, there is practically nothing known about their radiation resistance. In the present study, a high entropy alloy of composition 27%Fe-27%Mn-28%Ni-18%Cr, manufactured at ORNL, is ion irradiated at room temperature and at 500°C to doses ranging from 0.1 dpa to 10 dpa. Transmission electron microscopy (TEM), scanning transmission microscopy with energy diffraction spectrometry (STEM/EDX) and X-ray diffraction (XRD) were used to examine the radiation defects and microstructural changes. Irradiation at 500°C showed evidence of significant solute segregation at grain boundaries and discrete precipitates were observed; precipitation was not observed in the room temperature irradiated samples. Voids were not observed for any irradiation condition. Nano-indentation tests on the specimens showed a rapid increase in hardness ~40% higher than the unirradiated value at 0.1 dpa and to approximately double the unirradiated hardness at 1 dpa with the irradiation at room temperature. The irradiation hardness was less pronounced for 500°C irradiations. The present study provides insight of the fundamental irradiation behavior of HEA material.