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Ferritic/martensitic steels are the leading candidate material for structural components in the design of Gen IV reactors. They are known to exhibit high mechanical strength, ductility and toughness in the unirradiated condition and show good irradiation resistance with respect to void swelling, irradiation creep, irradiation-induced phase instabilities and high temperature helium embrittlement. Determining the mechanical properties of these structural materials after exposure to irradiation damage is essential for the safe design of the reactors. Testing neutron irradiated, bulk specimens is expensive and requires the use of a hot-cell, however, self-ion irradiation can been used as a proxy to emulate the irradiation damage caused in these materials. A disadvantage to using ion-implantation is that only a small volume of irradiated material can be achieved, hence micromechanical testing methods are required.

In this work, a sample of T91 steel was irradiated using 70MeV Fe ions. Use of a high-energy accelerator provides a damage profile that extends to a depth of 6μm beneath the sample surface; a damage level of 20dpa is reached at approximately 5μm into the surface, before the Bragg peak. Although this is still a small volume of material, it provides ample material to perform micromechanical techniques including micro-cantilever bend testing and nano-indentation. Such experiments were performed both on the surface, and on cross-sections of the irradiated material. The poster reports data on results from nanoindentation experiments, both perpendicular to the irradiated surface and parallel in cross-section, as well as the yield stress measured from micro-cantilever testing. All experiments are performed in the irradiated and unirradiated regions of the sample.