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Radiation Damage from Atomic to Meso-Scales in Extreme Environments CRIS W. BARNES, M.A. BOURKE, S.A. MALLOY, F.G. MARIAM, F.E. MERRILL, MICHAEL NASTASI, E.J. PITCHER, D.J. REJ, J.L. SARRAO, J.S. SHLACHTER, Los Alamos National Laboratory — A foreboding materials challenge is to be able to withstand the 10–15 MW-year/m^2 neutron and heat fluence expected in the first wall and blanket structural materials of a fusion reactor. Overcoming radiation damage degradation is a key rate-controlling step in fusion materials development. New science, approaches, and facilities are needed at multiple scales. The objective of the new Center for Materials at Irradiation and Mechanical Extremes is to understand, at the atomic scale, the behavior of materials subject to extreme radiation doses and mechanical stress in order to synthesize new materials that can tolerate such conditions. The Matter Radiation Interactions in Extremes (MaRIE) concept is a National User Facility to realize the vision of 21^{st} century materials research and development. The Fission and Fusion Materials Facility (F^3) segment of MaRIE proposes to use the present proton linac at Los Alamos with a power upgrade to drive a spallation neutron source that can provide the required radiation environment. Coupled with integrated synthesis and characterization capability, F^3 would also provide the capability for in-situ measurements of transient radiation damage, using unique x-ray and charged particle radiography diagnostics.

Cris W. Barnes
Los Alamos National Laboratory

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