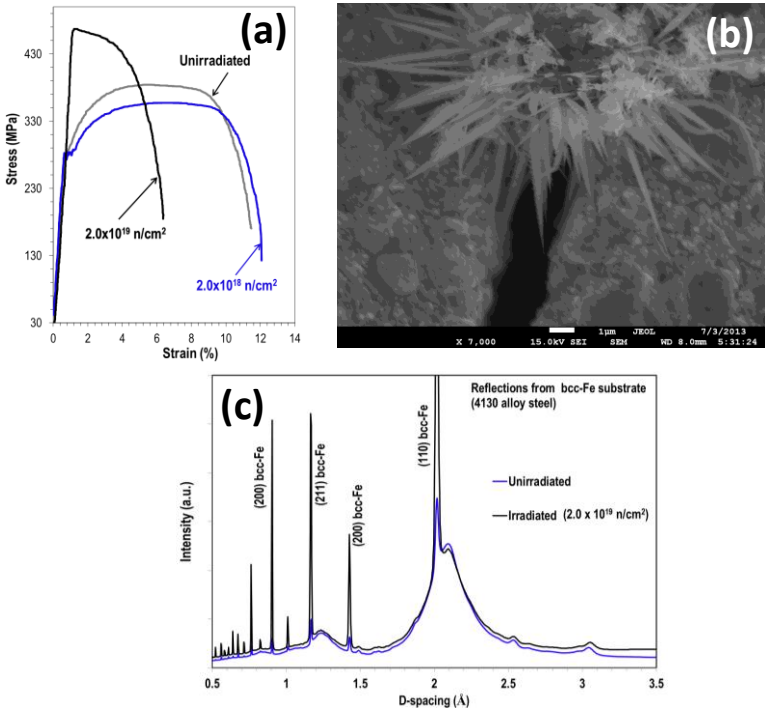
Fe-Based Nanocoatings Improve Nuclear Steel Properties in Extreme Environments



a) The effect of fast neutron irradiation on ductility exhibited by Fe-based nano-structured coating on steel, and b) amorphous-to-crystalline transition at 1000 °C. c) X-ray diffraction-based confirmation of amorphous coating structure and phases following neutron irradiation.

N. Simos, Z. Zhong, E. Dooryhee, G. Ghose, S. Gill, F. Camino, İ. Şavklıyıldız and E. K. Akdoğan, *J. Nucl. Mat.* **489**, 164-179 (2017).

Work was performed at Brookhaven National Laboratory

Scientific Achievement

Remarkable corrosion resistance and impedance to ductility loss was exhibited by amorphous Fe-based coatings on steel under fast neutrons and corrosive environment. The amorphous structure of the Fe-based coating was maintained for much higher neutron doses.

Significance and Impact

Ductility enhancement combined with corrosion protection offered by the Fe-based coatings represent a significant advancement in nuclear steels under extreme environments.

Research Details

- Spallation-generated fast neutrons, combined with corrosive environment were used to irradiate special steel samples overlaid with Fe-based nano-structured.
- Post-irradiation evaluation revealed dimensional stability, ductility loss resistance and superior corrosion resistance.
- X-ray diffraction studies at NSLS-II Beamline 28-ID revealed the evolution of phases and confirmed the amorphous structure with increasing neutron dose.