GEN IV International Forum
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Webinar Invite

Education and Training Working Group

Join us on May 11, 2022, 8:30 am EDT (UTC-4)

Development of Nanosized Carbide Dispersed Advanced Radiation Resistant Austenitic Stainless Steels (ARES) for Generation IV Systems

Austenitic stainless steels are widely used as in-core materials in current nuclear systems, due to the combination of good corrosion resistance, ductility, and mechanical properties. However, in the next generation nuclear systems to be operated at higher temperature and higher level of neutron irradiation, the use of austenitic stainless steels is largely avoided due to, mostly, poor void swelling resistance. In this regard, our research group developed an austenitic SS with uniformly distributed nanosized NbC precipitates, named as ARES-6P, by controlling chemical composition and thermo-mechanical processing. To demonstrate the radiation resistance, heavy ion irradiation was performed at high temperatures to the damage level of ~200 displacement per atom (dpa). The measured void swelling of ARES-6P was 2−3%, which was considerably less compared to commercial 316 stainless steel and comparable to ferritic martensitic steels. In addition, increment of hardness measured by nano-indentation was much smaller for ARES-6P compared to 316 stainless steel. Though some nanosized NbC precipitates were dissociated under relatively high dose rate (~5.0×10^{-4} dpa s^{-1}), sufficient number of NbC precipitates remained to act as sink sites for the point defects, resulting in such superior radiation resistance. Both significantly less void swelling and less irradiation hardening indicate the superior irradiation resistance of ARES-6P for the application of next generation nuclear systems.

Free webcast!

May 11, 2022
8:30 am EDT (UTC-4)

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Who should attend:
policymakers, managers, regulators, students, general public

Dr. Ji Ho Shin recently completed his PhD at the Korea Advanced Institute of Science and Technology (KAIST) in the field of nuclear materials on the subject of "Development of nano carbide dispersed advanced radiation resistant austenitic stainless steels (NC-ARES) for reactor internals." He worked on the development of next-generation nuclear materials, including Small Modular Reactor (SMR), Sodium Fast Reactor (SMR), and fusion reactor to demonstrate the superior radiation resistant features. He is currently a post-doctoral fellow in the Department of Nuclear and Quantum Engineering (NQE). Dr. Ji Ho Shin is also the winner of the audience favorite presentation during the 2021 Pitch your Gen IV research competition.

Upcoming Webinars

15 June 2022
Nuclear Waste Management Strategy for Molten Salt Reactor Systems, Dr. John Vienna & Dr. Brian Riley, PNNL, USA

27 July 2022
A Gas Cherenkov Muon Spectrometer for Nuclear Security Applications,
Mr. Junghyun Bae, Purdue University

28 September 2022
Development of In-Service Inspection Rules for Sodium-Cooled Fast Reactors Using the System Based Code Concept, Dr. Takaya, JAEA, Japan

For more information, please contact Patricia Paviet at patricia.paviet@pnnl.gov or visit the GIF website at www.gen-4.org

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