U.S. DEPARTMENT OF ENERGY
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ABSTRACT

Development of Materials for Supercritical-Water-Cooled Reactor

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Outline of Project

Supercritical-Water-Cooled Reactor (SCWR) was selected as one of the promising candidates in Generation IV reactors for its prominent advantages; those are the high thermal efficiency, the system simplification, the R&D cost minimization and the flexibility for core design. As the demand for advanced nuclear system increases, Japanese R&D project started in 1999 aiming to provide technical information essential to demonstration of SCPR technologies through three sub-themes of 1. Plant conceptual design, 2. Thermal-hydraulics, and 3. Material.

Although the material development is critical issue of SCWR development, previous studies were limited for the screening tests on commercial alloys and tentative manufacturing of new materials via simulated irradiation tests and un-irradiated corrosion tests. For the detailed design of SCWR system, further understanding of material behavior and the material database is necessary for the specific SCWR condition.

In this project, the irradiation durability and corrosion/SCC performance are evaluated, conducting the neutron irradiation tests under SCWR simulated condition and the following micro-analysis and corrosion tests in supercritical water for selected commercial alloys and new developed alloys. The long period reliability is also evaluated via phase stability tests and long period corrosion tests. Through these experimental studies, material behavior under SCWR condition will be sufficiently understood. The accumulation of basic material data under SCWR conditions enables us to construct a material database that is indispensable for the detailed design of fuel cladding and reactor core components.