

Brief Overview of R&D of SuperCritical-Water-cooled Reactor (SCWR)

超臨界圧軽水冷却炉の研究開発と課題

Akifumi YAMAJI*

Cooperative Major in Nuclear Energy, Graduate School of Advanced Science and Engineering,
Waseda University

Building 51, Nishi-Waseda Campus, 3-4-1, Okubo, Shinjuku-Ku, Tokyo, 169-8555, Japan

* E-mail: akifumi.yamaji@waseda.jp, Phone: +81-3-5286-8225

SuperCritical-Water-cooled Reactor (SCWR) is one of the Generation IV Reactor concepts with the following four key features: (1) simple and compact once-through direct cycle plant system; (2) high thermal efficiency by utilizing the steam cycle beyond the critical point; (3) utilization of the matured light water reactor and supercritical fossil fired power plant technologies; (4) flexibility in designing both the thermal and fast spectrum reactors with the same plant system. The basic research on the concept started in Japan in 1989 at Tokyo University with continuation of some of the works at Waseda University. Both the large-scale plant and small modular reactor (SMR) class plant can be designed. The major research and development (R&D) activities cover conceptual development of the plant system and acquiring and compiling basic database of the thermal-hydraulics, in-core material corrosion and water chemistry. Validity of the thermal-hydraulics design and feasibility of the material development has greatly improved in recent years. Thus, uncertainty in the development has been greatly reduced in recent years. Major R&Ds are ongoing in Canada, China, Euratom, Japan and Russia under the framework of the Generation IV International Forum (GIF) with technical secretariat from OECD Nuclear Energy Agency. IAEA Coordinated Research Projects have also been carried for the thermal-hydraulics. In Japan, Waseda University is currently leading conceptual core design studies of fast reactor core and SMR class core. Safety of the plant system including severe accident may be another area of work to be addressed.

Key Words

SuperCritical-Water-cooled Reactor (SCWR), once-through direct cycle, thermal reactor, fast reactor, core design, plant safety and control, thermal-hydraulics, material development, water chemistry, Generation IV reactor