Development of Autonomous Breeding Blanket for Compact Fusion Reactors

Project manager

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Leader's institution
National Institutes for Quantum Science and Technology (QST)

R&D institutions
QST, National Institute for Materials Science, IHI Corp., Toyota Industries Corp., Tohoku Univ., Shizuoka Univ., Kyoto Univ., Joining and Welding Research Institute, The Univ. of Osaka, Sanyo-Onoda City Univ., Kyushu Univ.

Summary of the project

The fuel-breeding blanket of a fusion reactor serves three essential functions: neutron shielding, energy conversion and recovery and fuel production.

This project aims to resolve the risk that conventional breeding blanket designs cannot secure sufficient plasma volume to achieve adequate fusion power output when reactor compactness is realized.

We aim to realize a groundbreaking breeding blanket that can achieve fusion power and stability sufficient for commercial operation even in an ITER-scale reactor, along with the potential to innovatively reduce the overall tritium inventory of the entire plant.

We are advancing the development of an advanced blanket (patent-pending idea - undisclosed) where thermal and neutron loading on the plasma-facing surface increases autonomously enhances heat removal performance and fuel breeding capability.

With its high versatility, we will establish this blanket design as the global standard, thereby accelerating the worldwide societal deployment of deuterium–tritium (DT) fusion.

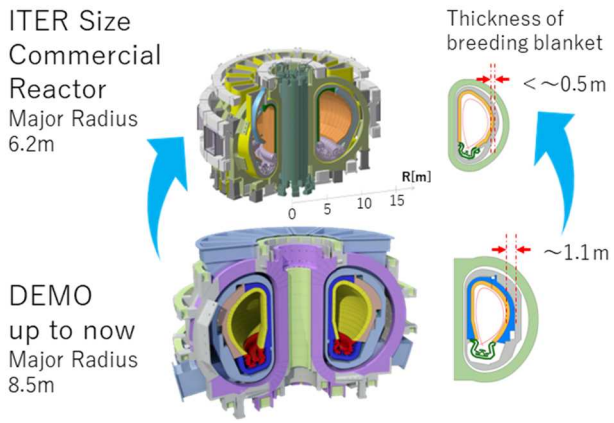

Fig. 1. Compact fusion-reactor design enabled by the advanced blanket

Milestone by 2034

Verification will be achieved by testing in simulated reactor environments to demonstrate that the technical challenges associated with the autonomous breeding blanket can be overcome, even under the in-vessel conditions of a DT fusion reactor.

Milestone by 2029

We aim to establish a clear prospect for the core elemental technologies essential to enabling the autonomous breeding blanket.

Project structure

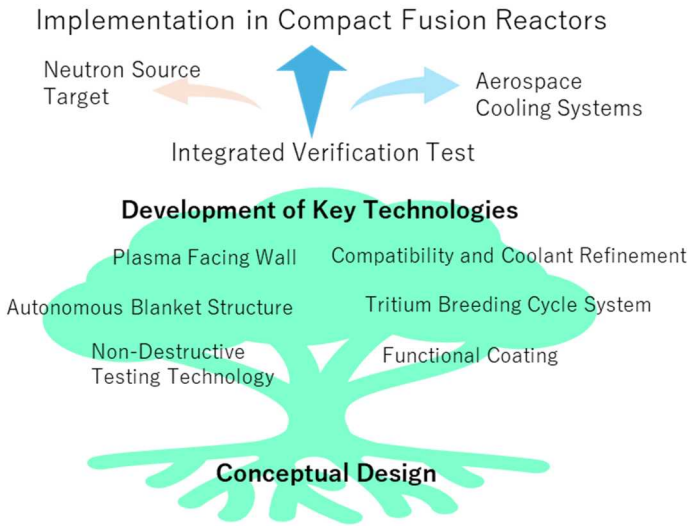

Fig. 2. R&D Framework.