NCSRD contribution to the realization of fusion energy

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The European roadmap for the realization of fusion energy is based on the operation of three key facilities: JET, ITER and DEMO. JET is currently the largest and most successful fusion experiment in the world and the only tokamak that has already demonstrated the use of D-T fuel mixture. It is considered to be the flagship device of the European fusion programme, serving also as the "test-bed" for all ITER technologies. The second landmark, ITER, will be – upon its completion – the world's largest tokamak, with ten times the plasma volume of JET. It is conceived as the last experimental step to prove the feasibility of fusion as a large-scale source of energy and is expected to achieve most of the important milestones on the path to fusion power. ITER will pave the way to the demonstration power plant DEMO, which will for the first time supply fusion electricity to the grid.

NCSRD Fusion Technology Group (FTG) contributes to this global-spanning venture, taking actively part in several JET, ITER and DEMO related projects. In particular, FTG participates in computational and experimental studies that are implemented at JET in direct support to ITER, contributes to ITER oriented experiments that aim to validate codes, models, assumptions and data currently used in ITER nuclear analyses as well as materials to be used for the main chamber and the divertor of ITER tokamak. These studies include neutron streaming and shutdown dose rate measurements, plasma – wall interaction, radiological and physical properties characterization of ITER materials, development and testing of neutron detectors, as well as radiation damage studies of functional materials. Moreover, FTG participates in the Breeding Blanket Project for integration in the DEMO power plant, contributing to experiments and calculations in support of the development of a Tritium Breeding Blanket system, in the DEMO Safety and Environment Project, performing activities related to Occupational Radiation Exposure Estimations, and in the development of radiation resistant structural and plasma facing materials for DEMO and beyond, through the understanding of radiation damage effects in materials.

This work provides an overview of NCSRD FTG activities, focusing on its contribution to the preparation for the successful launch and operation of ITER and DEMO.