Plenary 4

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- Session Chair: Jung-Sik Yoon (Korea Inst. of Fusion Energy, Korea)

Status of Research and Development for Demonstration of Fusion Energy

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Abstract

Fusion is the process that powers the sun and the stars. It takes place when light atomic nuclei fuse together to form a heavier one. When the lightest atom, hydrogen isotope, is heated to high temperatures, it becomes a plasma of ionized gas. In this plasma, a deuterium ion and a tritium ion could fuse to form a heavier ion of helium with emitting a neutron. In the process of fusing, some mass is converted into large amounts of kinetic energy of the neutron. The capability to contain this fusion reaction and harness the energy from it, are among the main goals of fusion research and development, which eventually leads to a new, sustainable and almost unlimited energy source on earth.

After understanding the fundamental physics of the sun energy source, physicists started research to realize the fusion energy on earth during last 60 years. As a result, significant technological and scientific achievements are induced from plasma science and fusion research. A plausible way suggested is the magnetic-confinement fusion in a device such as tokamak, stellarator, etc. Based on these basic studies by researchers, the ITER project is launched in 1988 as an international collaboration. The main purpose of the ITER is to demonstrate the scientific and technological feasibility of fusion power, by producing 500 MW of fusion power from a thermal input of 50 MW with a gain of 10. Seven Members (China, Europe, India, Japan, Korea, Russian Federation, and USA) contribute to building the ITER machine in Saint-Paul-lez-Durance of France. The ITER is the world's largest experimental facility with a first-of-a-kind fusion reactor that is inherently faced with technical challenges. Therefore, it is important for world-wide fusion communities to make their common effort towards the success of ITER (now 71% progress to the First Plasma). After construction and burning plasma operation of the ITER, all Members would set up to develop the commercial fusion plant of DEMO around the 2050s. It is noted that a number of efforts to accelerate the construction of the DEMO from each country are presented through long-term plans and roadmaps to fusion commercialization. Korea is also keen to achieve the fusion energy as a new or renewable energy source. Hence, the KO fusion community try to make every effort in preparing a technical ability and comprehensive strategy on the way towards DEMO in the areas of human resources and infra-structures for fusion R&D. In this presentation, the world-wide fusion R&D activities and roadmaps will be introduced and reviewed. In addition, perspective views on the demonstration of fusion energy on earth will be addressed.

Biography

Dr. Hyeon Gon LEE is the Vice President of Korea Institute of Fusion Energy (KFE) since 2019, who takes charge of management of R&D on the KSTAR operation, the K-DEMO design, and the plasma technology application. He is also serving as the Deputy Director General of ITER Korea, KFE since 2012. His research interests are the fusion science and engineering and plasma diagnostics, etc. He has published about 70 articles in physics and fusion science as author or co-author. He received his Ph.D. in Physics from the Graduate School of Ajou University, Korea in August 1996, following a Master Degree in 1985 and a Bachelor Degree in 1983 from the Seoul National University, Korea. He has

worked for 30 years at the KFE for R&D on the optical physics and the fusion science and engineering, including R&D as a staff member of the Korean Domestic Agency (KO-DA) for 15 years since 2004 after the accession of the Republic of Korea to a member state of the ITER Agreement. His research career was started from a study on the magneto-optical physics at the KBSI in 1990, and the research subject was moved to the optical Thomson scattering diagnostics of the plasma at the Hanbit mirror machine during 1996 - 2000. Based on this experience, he contributed to design of the Thomson scattering diagnostic system for the KSTAR during 2000 - 2005. Since 2005, he joined the Korean ITER Project as staff of the KO-DA for development of the Korean ITER diagnostics, which are the VUV Spectrometer, the Neutron Activation System, and an Upper Port Plug Engineering. In 2012, he promoted the Deputy Director General of the KO-DA to take full charges of managing all the technical areas for ontime and on-quality procurement of the KO packages, following the Head of System Engineering Division of the KO-DA in 2006.