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Status and prospect of nuclear fusion science for future energy source

"A method will be found for liberating fusion energy in a controlled manner within the next two decades", said the president of the UN conference* in 1955. This prediction was not regarded as so ambitious since fission power plants had been already in practical use after the Chicago Pile 1 in 1942. Actually we are behind this prediction, however, challenges toward the realization of fusion power plants have still been continued with passion as well as patience.

For fusion, a large-scale scientific experimental device ITER is under construction in France through global international cooperation. ITER aims at the first demonstration of controlled fusion burning by human beings, in the 2020s [(1)].

For fusion on the Earth, the nuclei of two kinds of hydrogen isotopes; Deuterium and Tritium, have to collide with each other at great speeds so that these two nuclei fuse against the electrostatic repulsion that exists between these positively charged nuclei. Different from a fission power plant where the solid fuels are fastened down in one place, the fuel for fusion is ionized gas referred to as "*plasma*" with extremely high temperature beyond 100 million degrees. Plasmas are representative media of complex non-linearity, randomly move and diffuse. These characteristics give rise to difficulties to realize a fusion power plant [(2)]. However, continuing scientific and engineering researches of fusion through a half century have cultivated broad and deep understanding of related physics and development of related technologies.

Fusion research has a great potential to change the world and accompanies academic creation.

***** 1st UN Conference on the Peaceful Uses of Atomic Energy, Geneva

References

(1) http://www.iter.org/
(2) "An Indispensable Truth", Francis. F. Chen, Springer, 2011

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