STATUS AND PROGRAMMES ON NEGATIVE ION BEAMS AT JAERI

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Various R&D on ion sources and accelerators has been carried out at JAERI mainly to realize the ITER NB system. KAMABOKO source demonstrated production of high current density H^- ions (300 A/m^2) at low operating pressure (0.3 Pa), which fulfilled the ITER requirement. In addition, uniformity issue of large negative ion sources has been tackled extensively, under collaboration with universities in Japan. The study revealed interesting results directly linked to physics of negative ion production process. The MeV accelerator development is also in progress. The achieved values of the JAERI accelerator are 800 keV and 100 A/m^2 (140 mA H^- ion current), whilst the ITER requirements on the beam energy and current density are 1 MeV and 200 A/m^2, respectively.

In parallel to the ITER activities, recently, design study of fusion DEMO plant was started at JAERI. The discussion identified possible range of requirements for the DEMO NB system, and necessary technical issues, such as beam energy and maintenance frequency for year-long steady operations. For reliable operation with less frequent maintenance, two R&D issues are considered necessary for ion source of the DEMO NB system. They are: 1) Filamentless plasma production, such as rf or ECR driven sources, and in the meantime, 2) Cesium free negative ion production. For the latter, low work function materials, such as LaB_6 and alkali-metal implanted materials are considered as candidate materials of the plasma grid, for a Cs free but surface production type negative ions source.

The paper reviews status of the R&D for ITER ion source and accelerator, followed by proposals of R&D programmes for the DEMO NB system, as a reasonable extension of present technologies, and also as possible improvement of the ITER NB system.