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Challenges of negative hydrogen ion sources for fusion URSEL FANTZ, Max-Planck-Institut fuer Plasmaphysik, EURATOM Association, Boltzmannstr. 2, 85748 Garching, Germany — The neutral beam injection systems for the international fusion experiment ITER (www.iter.org) are based on large negative hydrogen ion sources which have to operate at very ambitious parameters. They have to deliver an accelerated current of 40 A negative hydrogen ions extracted from 1280 apertures stable for one hour. The co-extracted electron current has to be kept below the extracted ion current to avoid damages of the grid system. At the source pressure of 0.3 Pa or below the negative ions have to be produced at a surface with low work function for which cesium is evaporated into the source. In order to fulfill all these requirements an R&D program has been launched several years ago. The challenges, however, are enormous; among them the control of the cesium dynamics in the source which determines the reliability of the source performance, the amount of co-extracted electrons which limits the extractable negative ion current, and the size scaling of the source towards an area of 1.9 x 1 m^2. Among the open and less understood issues are the magnetic filter field (initially used to reduce the electron temperature and density) in combination with the biasing of the grid surface, the sensitivity of the co-extracted electrons on cesium, the high co-extracted electron current in deuterium, and the fortunately weak correlation of the plasma homogeneity with the beam homogeneity. The present status, the most critical issues and open and less understood issues will be addressed and may serve as a trigger for a stimulating discussion or even trigger experiments and modeling activities to these topics.

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