

Lithium Jet Neutralizer to Improve Negative Ion Neutral Beam Performance

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Hydrogen isotope neutral beam systems for heating and current drive in magnetic fusion energy devices have always used gas cells composed of the beam isotope to convert a portion of the energetic ions into neutral atoms. In the design of negative-ion based neutral beams for the ITER tokamak, or for future fusion reactors, the large gas load from a traditional neutralizer cell causes many problems, including increased heat loads on the accelerator and ion source, reduced beam efficiency due to premature neutralization in the accelerator and reionization after the neutralizer, and the need to stop the beam for regeneration of the cryopanel, reducing the attractiveness of neutral beams for steady-state reactors. We have explored several approaches to decrease the neutralizer gas throughput, and conclude that a supersonic lithium vapor jet neutralizer is the most appropriate for ITER, and also affords a higher neutralization efficiency than does a hydrogen isotope gas cell. We discuss the design considerations for a lithium jet neutralizer, some of the developmental requirements, and the advantages to be gained.

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