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DESIGN OF CRYOGENIC TWIN SCREW HYDROGEN EXTRUDER SYSTEM

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Fuelling system is an important technological component of a fusion machine. With the advancement towards building up fusion reactors, plasma parameters like density and temperature are on rising scale. To have peaked density profile in such plasmas, fuelling by pellet injection has proved as efficient technology. India has its internal program for development of pellet injectors. The ingenuously developed SPINS-IND a single barrel pneumatic gun type pellet injector is successfully operating. The injector is able to freeze cylindrical pellets of size ranging from 1.8 mm to 4 mm. Pellet velocities achieved is a function of pellet size and propellant pressure. SPINS-IND has the achieved velocity range of 700-1000 m/s for 4-2 mm size pellets. Taking a step further development of twin screw cryogenic extruder system is undertaken at Institute for Plasma Research (IPR), India. The present extruder is a twin screw system comprising of in-line pre-cooler, liquefier and solid extrusion section. Solid hydrogen is produced and pushed forward with counter-rotating inter-meshing screws driven by servomotor capable of extruding sufficient solid hydrogen to get 3 mm (L) x 3 mm (D) size pellets at 10 Hz injection frequency. The concept of twin screw assembly, its support mechanism and stage wise cooling of hydrogen is discussed. Designed twin screw assembly is having screw root diameter of 28 mm with 10 mm screw pitch length, which can withstand a torque of 100 N-m. The screw cavity has rectangular cross section with inter-meshing angle of 54.53 degrees. In this paper the design methodology of screw elements will be discussed with its allied support to operate at cryogenic temperature. Design and analysis of screw gear, spline shafts and barrel with screw elements will also be presented.

Eligible for student paper award?

Yes

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