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2.31 Development of an Electrostatic Dust Injector for Impurity Injection in Tokamak Plasmas

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Impurity injection can be a critical tool for studying impurity transport as well as in understanding physics of plasma-wall interactions in magnetic fusion. Impurity injection can also enable important diagnostic approaches such as spectroscopy and CHERS. While the speed limitations on gas injection and pellet injection are well known, electrostatic and electromagnetic injectors can overcome such limits and can in principle deliver impurity content in the km/s range. With this in mind, we have begun development of a high-voltage electrostatic dust injector, capable of launching large quantities of small (< 0.1 mm) particles to high speeds (> 100 m/s). This injector is an evolution of a design currently in use at the Univ. Colorado Dust Accelerator, a facility for planetary science and cosmic dust studies. The dust injector consists of a dust reservoir, a HV needle (or collection of needles), and a series of exit apertures. The reservoir holds approximately 1g of dust, and the apparatus is pulsed to 20 kV to charge and launch the particles. Studies are underway to maximize the mass flux achievable in such a design, through the optimization of the reservoir, needle, and aperture geometries, as well as the size distribution of the dust particles and the waveforms of the pulsed HV.

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