Dust Measurements in Tokamaks*

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Dust production and accumulation impose safety and operational concerns for ITER. Diagnostics to monitor dust levels in the plasma as well as in-vessel dust inventory are currently being tested in a few tokamaks. In DIII-D dust diagnostics include Mie scattering from Nd:YAG lasers, visible imaging, and spectroscopy. Laser scattering resolves particles between 50–200 nm in diameter; the total dust content in the edge plasmas and trends in the dust production rates within this size range have been established. The diagnostic would benefit from an increased laser beam diameter, eliminating dust ablation by the beam, reducing detector saturation, and increasing the dust observation rate. Individual dust particles are observed by visible imaging using fast-framing cameras, detecting dust particles of a few microns in diameter and larger. Dust velocities and trajectories are determined in 2D with a single camera or 3D using multiple cameras, but determination of particle size is problematic. In order to calibrate diagnostics and benchmark dust dynamics modeling, pre-characterized carbon dust has been injected into the lower divertor of DIII-D. Injected dust is seen by cameras, and spectroscopic diagnostics observe an increase of carbon atomic, C_2 dimmer, and thermal continuum emissions from the injected dust. The latter observation can be used in the design of novel dust survey diagnostics. Dust accumulation is likely to occur in hidden areas, e.g. between tiles and under divertor baffles. A novel electrostatic dust detector has been developed and tested at NSTX for monitoring dust in these regions.

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TOTAL CHARACTERS ALLOWED: INVITED = 2000

TOTAL CHARACTERS USED = 1992