Dependences of Laser Measured Dust Densities in the SOL at DIII-D With Operational Configuration*

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Dust particles are observed by Rayleigh/Mie scattering of ND:YAG lasers during plasma operations at DIII-D. The observed dust particles do not penetrate into the plasma core and the density decreases gradually over the observed normalized radius in the scrape off layer (SOL) ($1.0<\Psi<1.2$ for typical discharges) to the plasma edge. The small dust particle density (4000 m^{-3}) and Thomson observation volume (0.2 cm^3) reduce the observations to a set of 5193 dust particles from the 6152 discharges in the DIII-D 2004 to 2007 run campaigns. The dust detection rate is too low to study dust density evolution in individual discharges, but statistical studies of these particles show significant differences in the dust densities for different plasma configurations. There is a significant increase in dust density with H-mode discharges relative to L-mode and QH-mode discharges. The dust density in ELMy H-mode discharges is sensitive to many parameters including the pedestal temperature and ELM frequency and can increase as much as a factor of two with pedestal temperature for similar pedestal pressure and injected power. Dust density decreases 40% with increasing ELM frequency compared to shots with similar stored energy and less frequent ELMs. The energy in individual ELMs has been shown [1] to be inversely correlated with ELM frequency which shows a positive correlation of dust density with individual ELM power. Analysis of ELM mitigation shots show a significant decrease in the dust during ELM mitigation to levels similar to QH or L-mode discharges. These measurements suggest the particles are created by impulsive heating from ELMs and the dust density is relatively insensitive to the total heat flux to the wall.

[1] Leonard, A.W., et al., Plasma Phys. Control. Fusion **44** (2002) 945.

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