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Characterization of the plasma plume in the current overrun regime of cylindrical Hall thrusters[1] ERIK M. GRANSTEDT, Princeton University, Y. RAITSES, N.J. FISCH, PPPL — Cylindrical Hall thrusters (HTs)[2] may be more promising than annular HTs for low-power scaling due to a smaller surface-to-volume ratio. High plasma plume divergence is a main drawback to cylindrical HTs as decreased efficiency and spacecraft integration issues may result. Recent measurements of the plume angle show that overrunning the discharge current above its self-sustained value can significantly decrease plume divergence. In this "current-overrun" regime, the half-plume angle of the cylindrical HT was reduced to 55°. Thrust measurements demonstrate that the current-overrun regime can have an anode efficiency of up to 35–40% at 100–200 W discharge power levels: an improvement of over 60%. Measurements of the ion energy distribution function in the plasma plume using a retarding potential analyzer reveal both increased ion current density and ion energy on-axis, indicating that these ions are ionized in a region of higher plasma potential. Also, the average energy of off-axis ions is substantially reduced, resulting in improved performance and lowered risk of damage to spacecraft components.

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[2]Y. Raitses and N. J. Fisch, *Phys. Plasmas* 8, 2579 (2001)

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