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Experimental investigation of plasma torch dynamics using magnetic diagnostics GANESH RAVI, VIDHI GOYAL, SUBROTO MUKHERJEE, Institute for Plasma Research — In a plasma torch, fluid and electromagnetic forces compete with each other and determine the movement of plasma arc root and the plasma column, which leads to fluctuations in the plasma column and associated quantities. In the present work, plasma dynamics inside a low power dc non-transferred arc plasma torch has been investigated using novel magnetic diagnostics that consists of garlands of magnetic (B-dot) probes incorporated inside the anode water cooling channels. Results show that the probes are able to capture fast rotation of the arc root under the influence of external magnetic field, not captured even by fast imaging. The phenomenon of arc root shunting is also captured by the probes. Thus, the complete spatiotemporal evolution of the plasma column is unraveled using these diagnostics. Results also show that volume return currents give way to constricted line currents in the anode return path when J x B force exceeds a threshold value due to formation of space varying eddy currents. A physical model explaining the processes is presented. The results have thus paved way for exploring magnetic tomography of plasma torch for better control and predictability of processes in a thermal plasma system.

Ganesh Ravi
Institute for Plasma Research

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