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Computational study to capture flow dynamics in a DCP-jet-assisted RF ICP torch

Abstract:

Computational schemes and algorithms to capture flow dynamics in and around a high-enthalpy thermal plasma are discussed. The dynamic behaviors of the high-temperature plasma and multi-scale vortices in an RF ICP (Radio Frequency Inductively Coupled Plasma) torch without or with a DCP (Direct Current Plasma) jet assistance are simulated. A tornado-like flow is induced by the electromagnetic force in the high-temperature RF ICP and forms large vortices which have been known to prevent materials to be injected into the plasma in material processes. The DCP jet breaks those vortices and supports material injections. Meanwhile, small vortices are generated in the low-temperature region around the plasma because of Kelvin-Helmholtz instability. The temperature field shows low-frequency fluctuations. Meanwhile, the vorticity field includes harmonic components as well as a low-frequency base component in its fluctuations.

Biography:

Full professor at Tohoku University since 2021