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Theoretical study of ablation of cylindrical particulate in Plasma

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Pellet injection is the way to provide fuel replenishment in fusion devices. The technique has been also adopted, and actively studied to establish its variant as methodologies for instability suppression, e.g. ELMs using Li pellet, and protecting inner surface via mitigation by a shatteredpelletinduced radiation. Sometimes, such pellet is produced in a cylindrical shape, corresponding to its guiding tube. So, its ablation may deviate from a conventional ablation model assuming spherical shape.

In the study, upstream plasma electrons are assumed to satisfy Maxwellian distribution. Electron flux before reaching electrostatic sheath is modified by atomic processes. In an ablation cloud region, the electrons undergo inelastic collisions under the process of excitation and ionization. Maxwellian flux for electrons is modified by exploiting Saha equation for ionization and rate coefficient for excitation. Net ion flux is assumed to be equal to net electron flux to set up an equilibrium floating potential and net heating flux on a cylindrical particulate. Then, the ablation develops corresponding to the particulate shape and the plasma parameters. A magnetic field is not currently included in the study.

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