

Numerical investigation on effect of water injection to decompose CF₄ gas in thermal plasma treatment

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Perfluorocompounds (PFCs) are widely using as etching and cleaning gases in the semiconductor and display industries. Among the PFCs, CF₄ was decomposed by nitrogen thermal plasma in this work because CF₄ can be completely decomposed at a high temperature environment over several thousand degrees in Kelvin. In this work, water was sprayed into the reactor as a chemical reactants source because it is easily decomposed H, O and OH radicals in a high temperature environment. Two kinds of water spray methods were compared; water sprays to the arc plasma flame (type A) and to the reactor tube wall (type B). In spite the same operating condition of input power, waste gas flow rate and water flow rate were employed at each water spray type, the higher decomposition rate of 93 % was measured in the case of type B.

In order to investigate effects of water spray method on this process, it is carried out that a numerical simulation on the thermal plasma flow characteristics considering water injections in the reactor. Temperature and velocity fields were mainly analyzed in a two-dimensional axisymmetric domain depending on water spray directions.