

STUDIES ON PLASMA HEAT TRANSFER

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ABSTRACT Our studies on plasma heat transfer are presented in the special session in honor of Dr. Emil Pfender.

1. Effects of Electric Field on Plasma Heat Transfer

The heat input rate from a plasma to a solid surface is strongly influenced by ions and electrons into/out of the solid surface which contacts with a plasma and by the ohmic heating which is generated by an electric current in a plasma.

2. State in Boundary Layer

The boundary layer is formed on the solid surface which is located in a thermal plasma flow. Whether the state in the boundary layer is in thermal equilibrium or not was investigated. The effect of the state on plasma heat transfer was also discussed.

3. Coal Particle Decomposition

A volatile matter in a fine coal particle can be decomposed by a thermal plasma. The decomposed gas is ejected into a plasma and acetylene gas is prepared. The gas ejection decreases the heat transfer rate from a plasma to a coal particle.

4. Enhancement of Vaporization by Chemical Reaction

The vaporization from a solid surface is promoted by an exothermic chemical reaction between the vapor and a reacting plasma which occurs near the surface. The gradient of the vapor concentration near the solid surface becomes large due to the consumption of the vapor by the reaction. This causes the higher mass transfer rate.

5. Heat Transfer Promotion by Dissociation

The heat transfer from a plasma to a solid surface is promoted by adding the dissociating gas. N_2 or O_2 which is introduced upstream is dissociated and becomes N or O. This recombines on the solid surface releasing the heat.