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Laminar free convection from a vertical plate in partly dissociated gases. (English)

Zbl 0971.76083

Int. J. Heat Mass Transfer 43, No. 7, 1113-1120 (2000).

Summary: Two-dimensional steady free convection from an isothermal vertical plate is studied in a gas where a reversible fast reaction of dissociation $A \leftrightarrow 2B$ takes place at atmospheric pressure. The effective properties in the presence of dissociation are evaluated. The governing boundary-layer equations are solved numerically for a wide range of values of the independent variables. All the data obtained are correlated by a single correlation, even if the temperature interval in the boundary layer (T_w, T_∞) is allowed to vary in a wide range, both in relative location and width, in respect to the temperature interval of dissociation. The correlated dimensionless parameters include the ratio ρ_w/ρ_∞ and are defined through the mixture effective properties calculated at T_w and T_∞ . The maximum absolute value of relative error depends essentially on two parameters: α related to variations of fraction of moles, and effective mass density ρ^* in the boundary layer.

MSC:

- 76R10 Free convection
- 76N15 Gas dynamics, general
- 76V05 Reaction effects in flows
- 80A20 Heat and mass transfer, heat flow (MSC2010)

Keywords:

steady free convection; isothermal vertical plate; reversible fast reaction of dissociation; atmospheric pressure; effective properties; boundary-layer equations; correlation

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