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Dissociation and recombination reactions for diatomic Nitrogen in Argon-Nitrogen mixed gaseous thermal plasma SAHADEV PRADHAN, A. K. KALBURGI, Chemical Technology Division, Bhabha Atomic Research Centre, Mumbai-400085, India. — The dissociation and recombination reactions for diatomic Nitrogen in Argon-Nitrogen mixed gaseous thermal plasma with initial state composition 75 mol% of Argon and 25 mole% of Nitrogen, having two rotational degrees of freedom for Nitrogen molecules and with no internal degrees of freedom for Argon and electron, is studied using Direct Simulation Monte Carlo (DSMC) simulations The dissociation of a molecule is considered to take place when the Larsen-Borgnakke selection of energy into the vibrational mode leads to a level beyond the maximum level. During the dissociating collisions it is thought that the rotational mode of the molecules have disappeared, while the recombination reactions are considered to be based on the equilibrium collision theory, and the ratio of the recombination cross-section to the elastic cross-section in an atom-atom collision is determined through $\sigma_R / \sigma_T = 2C\ (1+(E_d / ((?+3/2 - ?)k_B\ T)))\ ((n_T V Q^{A2})/(Q^A)^2)$ The equilibrium degree of dissociation, which corresponds to the rate of recombination same as rate of dissociation, is computed for initial number densities in the range $10^{22} < n_O < 10^{25}$,with equilibrium temperatures $3000\ K < T_{eq} < 20{,}000\ K$, and compared with the theoretical equilibrium state, and found excellent agreement (error within 2%) An important finding is that the extent of recombination process decreases linearly with the initial number density, and under rarefied condition they can be ignored.

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