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A Global Enhanced Vibrational Kinetic Model for Investigation of Negative Hydrogen Ion Sources SERGEY AVERKIN, NIKOLAOS GATSONIS, Worcester Polytechnic Institute — A new Global Enhanced Vibrational Kinetic Model (GEVKM) is developed for modeling negative hydrogen ion production and destruction processes in low (mTorr level) to high pressure (Torr level) ion sources. GEVKM couples steady-state space averaged continuity equations for ground-state neutral H_2, H species, 14 vibrationally excited molecular hydrogen species $H_2(v)$, positive ions H^+,H_2^+,H_3^+,negative ions H^-, electronically excited hydrogen atoms H(n=2-3), and electrons with electron energy and total energy equations. Compared to previous global models GEVKM includes a full vibrational kinetics treatment, a self-consistent evaluation of heavy particle temperature and spatial variation of species densities in estimation of wall fluxes. The input parameters to GEVKM are ion source geometry, inlet hydrogen flow rate and absorbed power and outputs include concentration and temperature of all species.The GEVKM is verified and validated by comparisons with previous experimental and computational results for a low pressure (10-100 mTorr) volume negative ion source and a high pressure (10-100 Torr) microwave generated hydrogen plasma reactor. The GEVKM is also used for a parametric investigation of a new high pressure negative hydrogen ion source that includes the RF discharge chamber and a nozzle.

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