Diagnostics and kinetic modeling of the ignition and the extinction transients of a hollow cathode N2O discharge

Abstract: The present work describes the first experimental study of the transients involved in the turn on and off of a N2O hollow cathode discharge until the attainment of the respective stationary states. Time-resolved Fourier transform infrared spectroscopy and quadrupole mass spectrometry with ionization by electronic impact have been used to measure the temporal evolution of the concentrations of the stable species present in the discharge N2O, N-2, O-2, NO, and NO2. A model based on a reduced set of kinetic equations gives a global account of the measured data; this model takes into account all the mechanisms considered in a former work (Arcos, T. et al. J. Phys. Chern. A 1998, 102, 6282) to explain the steady state of a continuous N2O discharge but includes also additional mechanisms to which transient phenomena have proven to be much more sensitive than the stationary results. In particular, excitation of some vibrational levels of N2O and homogeneous reactions of vibrationally excited species, as well as electron impact dissociation of the stable products of the discharge are considered. On the other hand, the partial formation of NO2 by an heterogeneous reaction previously proposed seems to be confirmed.