Abstract Submitted
for the GEC08 Meeting of
The American Physical Society

Numerical Simulations of an atmospheric pressure discharge using a two dimensional fluid model MUHAMMAD M. IQBAL, MILES M. TURNER, Dublin City University, Ireland — We present numerical simulations of a parallel-plate dielectric barrier discharge using a two-dimensional fluid model with symmetric boundary conditions in pure helium and He-N_2 gases at atmospheric pressure. The periodic stationary pattern of electrons and molecular helium ions density is shown at different times during one breakdown pulse for the pure helium gas. The temporal behavior of the helium metastables and excimers species density is examined and their influences on the discharge characteristics are exhibited for an APD. The atmospheric pressure discharge modes (APGD and APTD) are affected with small N_2 impurities and the discharge mode structures are described under different operating conditions. The uniform and filamentary behavior of the discharge is controlled with the variable relative permittivity of the dielectric barrier material. The influence of nitrogen impurities plays a major role for the production of the filaments in the after glow phase of He-N_2 discharge and the filaments are clearly observed with the increased recombination coefficient of nitrogen ions. The creation and annihilation mechanism of filaments is described with the production and destruction of nitrogen ions at different applied voltages and driving frequencies for a complete cycle. The results of the fluid model are validated by comparison with the experimental atmospheric pressure discharge results in He-N_2 plasma discharge.

Miles Turner
Dublin City University

Date submitted: 13 Jun 2008 Electronic form version 1.4