Abstract Submitted
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Solution of the Electron Fluid Dynamical Equations MOSTAFA HEMMATI, Arkansas Tech University — To describe the breakdown waves, we use a one-dimensional, steady-state, three-fluid, hydro-dynamical model with a shock front. We assume that the electron gas partial pressure is much larger than the partial pressures of the other species and therefore provides the driving force for the propagation of the wave. The wave is composed of two distinct regions: a thin dynamical transition layer followed by a relatively thicker thermal layer. In the transition region, the electrons slow down to speeds comparable to those of heavy particles as the electric filed falls to zero. In the thermal layer, the high temperature electron gas will cool, resulting in more ionization. The set of equations used to investigate these waves consists of the equation of conservation of mass, momentum, and energy coupled with Poisson's equation, and is known as the electron fluid dynamical (EFD) equations. We have replaced the assumption of ionization rate being a function of temperature only, by a computation based on the free trajectory theory by Fowler; in which the ionization rate changes from accelerationnal ionization at the front of the wave to directed velocity ionization in the intermediate stages of the wave to thermal ionization at the end of the wave. Using Fowler's equation to calculate the ionization rate, we have been able to integrate the EFD equations through both, the transition and thermal layers of the wave. The results conform to the expected conditions at the end of both layers. Wave profile for the electric field, ionization rate, and electron velocity, temperature, and number density will be presented.

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