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Breakdown characteristics of xenon HID Lamps[1] NATALIA BABAEVA, University of Michigan, AYUMU SATO, NANU BRATES, KOJI NORO, Universal Lighting Technologies, Inc., MARK KUSHNER, University of Michigan — The breakdown characteristics of mercury free xenon high intensity discharge (HID) lamps exhibit a large statistical time lag often having a large scatter in breakdown voltages. In this paper, we report on results from a computational investigation of the processes which determine the ignition voltages for positive and negative pulses in commercial HID lamps having fill pressures of up to 20 atm. Steep voltage rise results in higher avalanche electron densities and earlier breakdown times. Circuit characteristics also play a role. Large ballast resistors may limit current to the degree that breakdown is quenched. The breakdown voltage critically depends on cathode charge injection by electric field emission (or other mechanisms) which in large part controls the statistical time lag for breakdown. For symmetric lamps, ionization waves (IWs) simultaneously develop from the bottom and top electrodes. Breakdown typically occurs when the top and bottom IWs converge. Condensed salt layers having small conductivities on the inner walls of HID lamps and on the electrodes can influence the ignition behavior. With these layers, IWs tend to propagate along the inner wall and exhibit a different structure depending on the polarity.

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