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Charged particle motion in an explosively generated ionizing shock C. BOSWELL, P. O'CONNOR, IHDIV, NSWC — Several previous studies have investigated the shock generated in a guide tube by an explosive and the ejecta from the explosive and electric and magnetic phenomena associated with it. In these studies the question has arisen, but not satisfactorily answered, as to what is the cause of the wave that travels ahead of the ionizing shock wave. We hypothesize that this wave is an electrostatic pulse, carried by charged particles, created by the photoionization of the gas in the guide tube and the electric field pulse generated when a detonation wave reaches the end of an explosive. Therefore, we studied the motion of charged particles using Rogowski coils and the compressed gas and detonation products behind the shock wave using a time-resolved emission spectroscopy. The shock wave in the gas was generated by an explosive located at one end of a guide tube filled with a gas, typically argon, krypton, or nitrogen. The detonation produced a shock wave strong enough to ionize the gas. Spectral line emission profiles, recorded with a time-resolved emission spectroscopy system, were used to measure temperatures of 7000 K and electron densities of 5 x 10^{22} m^{-3}. The Rogowski coils were used to measure a wave of charged particles traveling down the guide tube with a phase velocity of 550 km/s in krypton and 1300 km/s in argon. The results are consistent with the hypothesis that an electrostatic pulse travels down the guide tube, offering a possible explanation for the observed wave.

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