Analysis of shock induced depolarization and current generation in ferroelectric ceramics[1] VINAMRA AGRAWAL, KAUSHIK BHATTACHARYA, California Institute of Technology — Ferroelectric generators are used to generate large magnitude current pulse by impacting a polarized ferroelectric material. The impact causes depolarization of the material and at high impact speeds, dielectric breakdown. The current or voltage profiles obtained vary depending on the loading conditions. In this study, we explore the large deformation dynamic response of a ferroelectric material. Using the Maxwell's equations, conservation laws and the second law of thermodynamics, we derive the governing equations for the phase boundary propagation as well as the driving force acting on it. We allow for the phase boundary to contain surface charges which introduces the contribution of curvature of phase boundary in the governing equations and the driving force. This type of analysis accounts for the dielectric breakdown and resulting conduction in the material. Next, we implement the equations derived to solve a one dimensional impact problem on a ferroelectric material under different electrical boundary conditions. The constitutive law is chosen to be piecewise quadratic in polarization and quadratic in the strain. We solve for the current profile generated in short circuit case and for voltage profile in open circuited case.

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