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Two-dimensional numerical modeling of electric field and correlation to breakdown –Area scaling

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An attempt was performed to illustrate dielectric breakdown and volume/area scaling in non-uniform fields. Actual scanning electron microscopy image of electrode surfaces were used (after digitization) with an effective medium approach, where the material assumed was an representation of a composite. The digitized outline uploaded to a finite element numerical solver. Electric field calculated and stress regions were estimated using the simulation and the results were correlated to the measured breakdown values for the composite material. The stressed area estimated were converted to cumulative distribution function (Weibull-like plot) to achieve the correlation. Data from simulations and breakdown measurements were overlapped fine for a given intrinsic breakdown threshold! The proposed method can be used in other physical property characterization such as thermal and mechanical stresses.

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