

Luminescence and Space Charge Phenomena in Polymeric Dielectrics

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Abstract

Polymers are extensively used as insulating material in high voltage devices, such as underground power cables, power capacitors and transformers. During normal operation the polymeric insulation of a power device is not only subjected to electrical stresses, but could also be subjected to thermal, mechanical and environmental stresses. These stresses either acting singly or in combination can cause the degradation which leads to insulation failure. It has been well established that electroluminescence (EL) and charge injection, which gives rise to space charge in the polymeric insulation, occur at ac, dc and impulse field above a certain threshold value. Space charge can cause dissipative energetic processes such as photon and phonon emission, increase the local electric field, lead to the reduction of the insulation withstand voltage and ultimately to premature failure of the power device. This paper describes the characteristics of EL in polymeric insulation subjected to ac voltage and shows its relevance to space charge injection in the material. It is shown that insulation subjected to HV could emit various types of light but EL emission which is related to charge injection can be differentiated from these other types of light emission. The EL technique can be used to develop and evaluate novel dielectric materials, such as nanodielectrics.