Influence of bulk dielectric polarization upon partial discharge transients effect of heterogeneous dielectric geometry

A physically valid theory of partial discharge (PD) transients is based upon the concept of the charge induced upon the detecting electrode by the PD. This induced charge consists of two components. One is associated with the actual space charge in the void, while the other is related to changes in the polarization of the bulk dielectric. These changes are brought about by the field produced by the space charge. The magnitude of the induced charge and its components are examined for several heterogeneous dielectric systems. It is demonstrated that, in relation to a homogeneous dielectric system, the magnitude of the induced charge either increases or decreases depending on the ratio of the dielectric permittivities and within which dielectric the void is located. It is shown that this behavior is directly related to the magnitude and polarity of the polarization component of the induced charge. Furthermore, we demonstrate that the geometry of the dielectric system and the physical dimensions of the different dielectrics influence in a similar manner the magnitude of the induced charge, although to a lesser degree.