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Dielectric relaxation and electrical conductivity in ferroelectric ceramic/polymer composites around the glass transition

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The lead titanate ceramics are potential useful ferroelectric materials but exhibit high stiffness constant and high density, which make them mechanically less stable. To overcome these problems, ferroelectric ceramics/polymers composites are developed, where the space charge can be difficult to be described due to the complex dynamic processes involved. As a result, the classical Debye's relaxation model may not be appropriate to describe the electric spectra. In this work, the electrical properties of the (Pb0.88Sm0.08)(Ti0.99Mn0.01)O3/polyetherketoneketone ceramic/polymer composite is investigated in a wide temperature and frequency range around the glass transition. The universal relaxation law was applied to modelate the experimental response. The dc conductivity (dc) and the hopping frequency (H) followed an Arrhenius' dependence. On the other hand, the activation energy values for dc were associated to oxygen migration. The contribution of the conductive processes to the dielectric relaxation was analyzed, considering the oxygen concentration in the ceramic phase.