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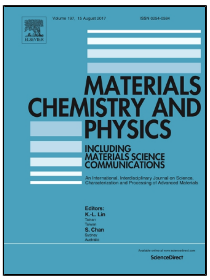

Enhanced Dielectric Properties induced by loading Cellulosic Nanowhiskers in Natural Rubber: Modeling and Analysis of Electrode Polarization

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Enhanced Dielectric Properties induced by loading Cellulosic Nanowhiskers in Natural Rubber: Modeling and Analysis of Electrode Polarization

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ABSTRACT

Natural rubber (NR) isolated from Hevea Brasiliens and reinforced with different amounts of cellulose nanowhiskers (extracted from the rachis of date palm tree) was investigated using differential scanning calorimetry and dielectric spectroscopy in the frequency range 0.1Hz to 1MHz, and the temperature range -80 to 200°C. The experimental dielectric data were analysed within the formalisms of dielectric permittivity, complex conductivity and complex modulus. The results were discussed in terms of dc conductivity, interfacial polarization and electrode polarization. The paper aims to investigate especially the electrode polarization observed at low frequency and/or high temperature (LF/HT). It is exhibited that the understanding of the frequency space charge relaxation behaviour trapped close to the material/electrode interface will help one to elucidate the charge dynamics in the quasi static range. So charge carrier concentration and mobility in the sample at high temperature can be evaluated through the electrode polarization modeling of broadband dielectric spectroscopy data.

Keywords: Nanocomposites; Polymers; Electrical properties; Dielectric relaxation; Electrode polarization

I. Introduction

Bio-based nanocomposites are a relatively new class of nanomaterials and are of great interest in nanocomposite research thanks to their environmental friendliness, biodegradability and biocompatibility. As one of the most prominent materials, cellulose nanowhiskers/Natural Rubber nanocomposites have attracted more and more attention because of their simple compounding methods and uniform nanoparticles dispersion in latex matrix. Hence, substantial research has been done regarding the extraction of nanowhiskers. Apart from their