World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

Study of the Physical Aging of Polyvinyl Chloride (PVC)

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Abstract : The insulating properties of the polymers are widely used in electrical engineering for the production of insulators and various supports, as well as for the insulation of electric cables for medium and high voltage, etc. These polymeric materials have significant advantages both technically and economically. However, although the insulation with polymeric materials has advantages, there are also certain disadvantages such as the influence of the heat which can have a detrimental effect on these materials. Polyvinyl chloride (PVC) is one of the polymers used in a plasticized state in the cable insulation to medium and high voltage. The studied material is polyvinyl chloride (PVC 4000 M) from the Algerian national oil company whose formula is: Industrial PVC 4000 M is in the form of white powder. The test sample is a pastille of 1 mm thick and 1 cm in diameter. The consequences of increasing the temperature of a polymer are modifications; some of them are reversible and others irreversible [1]. The reversible changes do not affect the chemical composition of the polymer, or its structure. They are characterized by transitions and relaxations. The glass transition temperature is an important feature of a polymer. Physical aging of PVC is to maintain the material for a longer or shorter time to its glass transition temperature. The aim of this paper is to study this phenomenon by the method of thermally stimulated depolarization currents. Relaxations within the polymer have been recorded in the form of current peaks. We have found that the intensity decreases for more residence time in the polymer along its glass transition temperature. Furthermore, it is inferred from this work that the phenomenon of physical aging can have important consequences on the properties of the polymer. It leads to a more compact rearrangement of the material and a reconstruction or reinforcement of structural connections.

Keywords : depolarization currents, glass transition temperature, physical aging, polyvinyl chloride (PVC)
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020