

Effect of Irradiation and Thermal Aging on PTC Characteristics of Conductive Carbon Black-Filled Polyethylene Composites

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Abstract

Effect of irradiation and thermal aging on PTC(positive temperature coefficient) characteristics of a conductive high density polyethylene/carbon black (HDPE/CB) composite was investigated. HDPE with a melt index of 0.35 was selected as the polymer matrix in this work. Carbon black with an average particle size 86 nm was used. The CB and polymer were mixed in a Brabender Plastograph at 160°C for 15 min. The CB/polymer blend thus produced was sandwiched between a pair of copper foils(0.04 mm thick), which served as electrodes. The thickness of the sample was approximately 0.5 mm. The HDPE/CB sheet was irradiated with gamma rays to a dosage of 60kGy, 120kGy and 180kGy to examine the behavior of the NTC(negative temperature coefficient) of the conductive composite. The conductive HDPE/CB composites preferably needs an antioxidant which stabilize the composites against thermo-oxidative degradation because they should be resistant to the severe condition of high temperature. Various types of anti-oxidants were added into the HDPE/CB. Thermal aging of PTC samples was conducted in an oven at 150°C for 140hr in air. The electrical properties of HDPE/CB composites were examined to determine the effect of antioxidants on the degradation of polymer. It was found that the peak resistivity of the compositions depended on the time of thermal aging treatment and the presence of antioxidants.