



RANDOM TELEGRAPH NOISE IN HDPE/MWCNT COMPOSITES NEAR PERCOLATION THRESHOLD

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Measuring the electrical conductivity of high density polyethylene (HDPE) / multi-walled carbon nanotube (MWCNT) composites with different CNT content, prepared by melt-mixing in a micro-twin screw extruder, a percolation threshold of the CNT concentration between 1wt% and 2.5wt% has been found [1]. Investigating in detail the DC electrical conductivity for a sample with a 2.5wt% CNT content, we observed at measurement temperatures below 90°C, that means clearly below the T_g, a low frequency random telegraph noise (RTN) signal with a current amplitude of about 3% of the DC current value. These fluctuations are due to the addition of single percolation paths. After heating the sample up to a temperature of 150°C (clearly above T_g) and subsequent cooling down to room temperature, the overall value of the relative intensity noise (RIN) has been increased, while the DC conductivity decreased by more than one order of magnitude. It can be stated, that noise measurements are again a clear pre-indicator of device degradation, as observed often for electronic devices [2]. These measurements show that for low-conductive HDPE/CNT composites a more complex noise behaviour is found, as compared to highly conductive samples. In the latter case, in particular for CNT concentrations of 5wt% and 7wt%, a classical 1/f behaviour has been found [3].