Low-frequency noise spectroscopy as an effective tool for electric transport analysis

Abstract

In this work, several experiments and analyses performed by means of noise spectroscopy, on a broad typology of materials and compounds, are presented. Structural, DC electrical transport and noise properties are exposed for each investigated sample, and theoretical models and possible explanations of the experimental results are given to unravel physical phenomena. In particular, two distinct types of iron-chalcogenide superconductors are investigated, in their pristine and aged state, suggesting the more likely mechanism which generates the resistance fluctuations and resorting to Weak Localization theory. In the case of the polymer/carbon nanotubes composites, the fluctuation-induced tunneling model is introduced to explain the measured temperature dependence of the electrical conductance and the I-V curve behaviors. Then, noise measurements prove the existence of a structural phase transition occurring around 160 K within the perovskite compound and highlight the correlation between electronic defect states distribution and device performance.
The variety of investigated devices and materials validates the soundness of the noise spectroscopy as an effective tool for electric transport analysis.

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