Highlights

RESEARCH AREA 1 - **Superconductors and Innovative materials for Energy and Environment** - 2022

"Electrical conduction and noise spectroscopy of sodium-alginate gold-covered ultrathin films for flexible green electronics"

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Green electronics is an emerging topic that requires the exploration of new methodologies for the integration of green components into electronic devices. Therefore, the development of alternative and eco-friendly raw materials, biocompatible and biodegradable, is of great importance. Among these, sodium-alginate is a natural biopolymer extracted from marine algae having a great potential in terms of transparency, flexibility, and conductivity, when functionalized with a thin gold (Au) layer. The electrical transport of these flexible and conducting substrates has been studied, by DC measurements, from 300 to 10 K, to understand the interplay between the organic substrate and the metallic layer. The results were compared to reference bilayers based on polymethyl-methacrylate, a well-known polymer used in electronics. In addition, a detailed investigation of the electric noise properties was also performed. This analysis allows to study the effect of charge carriers fluctuations, providing important information to quantify the minimum metallic thickness required for electronic applications. In particular, the typical noise behavior of metallic compounds [Fig. 1 (a)] was observed in samples covered with 5 nm of Au, while noise levels related to a non-metallic conduction [Fig. 1 (b)] were found for a thickness of 4.5 nm, despite of the relatively good DC conductance of the bilayer.

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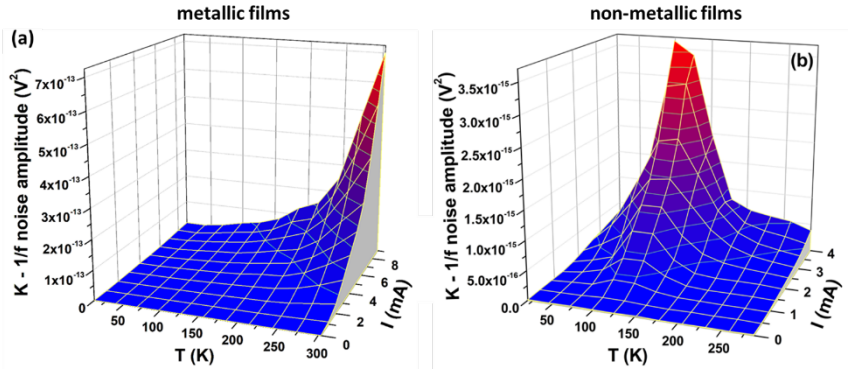

Fig. 1: The amplitude of the 1/f noise component is shown as a function of temperature and of bias current, in a three-dimensional plot, for metallic (a) and for non-metallic (b) sodium-alginate films.