

Electrical memorability in silver nanoparticle composite operated at the conductor-to-insulator percolation threshold

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The conductor-to-insulator (CtI) phase transition in silver-nanoparticle composites' static material and electrical properties has been explored for years, except for its potential for further applications based on dynamics, i.e., time-varying properties running. Traditional applied percolation theory suggested no hint of memorability demonstrated in our work. Then, our research examines the dynamic electrical behavior of silver-nanoparticle composites (SNPC), focusing on resistance change with time subjected to external pulses. As indicated by experimental results, an avalanche operating at SNPC's percolation CtI threshold resembled an enforcement process. The integrated time versus SNPC samples' critical exponent was also identified as an effective parameter for characterizing intrinsic properties. A thermal-based recovery treatment was then applied to erase stored information, showing that written and rewritten samples retained similar critical exponents. Encoding and decoding two four-alphabet strings into an SNPC sample have been demonstrated before and after thermal recovery. These insights support ongoing research into optimizing SNPCs' material properties and operational parameters for enhanced performance in such applications.

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