Emergent properties of neuromorphic nanowire networks

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Neuromorphic materials are those in which there is a complex interconnectivity between the different parts of the material with functional units having dynamics similar to that of neurons on living species. These materials can be created with different aggregates of nanomaterials, as atomic switch**[1]** or nanoparticle**[2]** networks. In this work, we have created a neuromorphic network composed of polymer coated silver nanowires synthesized under solution**[3],** which can be dispersed onto a glass substrate producing a layout of randomly connected nanojunctions. We observe that, performing IV spectroscopy as well as acquiring time series under different biasing schemes, the system behaves as an electrical network composed of individual switches whose dynamics is similar to that of memristors**[4]**. Using a computer modelization of such system, it will be shown how the interplay between the memristive properties of individual junctions and the topology of the electrical network formed by nanowires can account for its emergent properties, such as critical activation (Figure 1), short-term retention memory or adaptability to internal changes in the network.

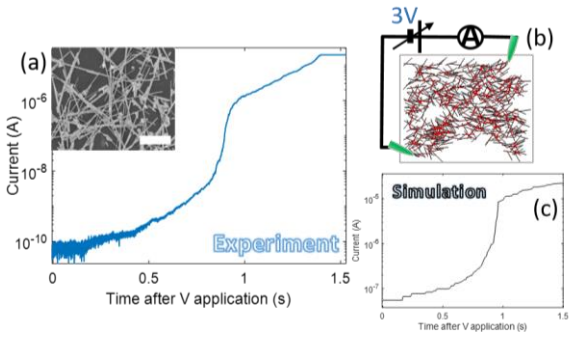

Figure 1: a) Supertreshold activation of nanowire network under 3V constant DC bias. Inset: SEM image showing nanowire layout. Scale bar: 10µm. b) Scheme of nanowire network and two-probe measurement. c) Simulated supertreshold activation curve under 3V constant DC bias.

References:

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