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Resonant tunnelling assisted electrical switching in amorphous-carbon multilayer-superlattice structures SOMNATH BHATTACHARYYA, S. R. P. SILVA, Advanced Technology Institute, University of Surrey, Guildford GU2 7XH — Negative differential resistance (NDR) in an amorphous carbon (a-C) double barrier resonant tunnel diode (DB-RTD) with an estimated cut-off frequency well into the gigahertz regime is reported [1]. Presently we extend this work in carbon multi-layer superlattice structures by showing room temperature resonant tunnelling and establish a high value of the phase coherence length of ∼10 nm for low-dimensional amorphous materials. By applying a high bias, these structures are modified with reversible current switching of up to four orders of magnitude with a NDR signature and multiple peaks representative of resonant tunnelling in the ON state. In addition to the formation of filamentary channels by applying high bias, all these features are also explained using concepts based on tunnelling through the interface of the carbon layers, quantum-dot heterostructures and the presence of a confined two dimensional electron gas. This switching behavior and its tunability have been tested by applying a microwave signal up to 100 GHz which suggest the potential for novel high-speed memory devices. [1] S. Bhattacharyya, S.J. Henley, E. Mendoza, L.G-Rojas, J. Allam and S.R.P. Silva, Nature Mater. **5**, 19 (2006).

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