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Low temperature transport study of the nitro molecules NABANITA MAJUMDAR, Z. MARTIN, N. SWAMI, L. HARRIOTT, University of Virginia, Y. YAO, J. TOUR, Rice University, D. LONG, R. SHASHIDHAR, Geo Center R&D Center — Various research groups, including ours, have observed switching with memory behavior at room temperature from a monolayer of oligo(phenylene ethynylene) (OPE) molecules with a nitro sidegroup.[1,2]. This switching behavior has the potential to be used in molecular electronic devices. However, the transport mechanisms of this "nitro" molecule are not well understood. Understanding the transport mechanisms of the nitro molecules may help identify the underlying cause of the switching behavior. We performed a systematic study of the transport characteristics of OPE molecules with and without a nitro side group in our nanowell test device[3] at various temperatures between 60K and 300K. We observed non-switching exponential current-voltage characteristics from OPEs without the nitro side group. The mechanism of transport was determined to be hopping with a transport barrier of 0.03±.01 V between 100K to 300K. Switching with memory behavior as well as non-switching exponential I-V characteristics were observed from the nitro molecules at various temperatures. The transport mechanism in switching devices was determined to be hopping with an activation barrier of 0.26±.08 V between 200K and 300K. However, a significantly lower activation barrier similar to that of OPEs without a nitro group was estimated for the nitro molecule devices that did not show any switching behavior.

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