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### **Negative Differential Resistance in Insulating Systems: From Molecules to Polymers**

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We have developed a microscopic theory to explain the negative differential resistance behavior in molecular bridges. This feature has been observed in many molecules with different on/off ratios, sharpness of the current peak and the critical bias. Our theory, based on simple dimer model (both Peierls and donor/acceptor) together with bias driven conformational/electronic change, covers almost all the experimental characteristics for a large number of real molecular systems and encompasses all the theory that has been known till date. Similar argument is also extended to Mott insulator, where we find a large number of insulator/quasi-metal transitions in finite size chains and a thermodynamic insulator/metal transition in polymers due to the application of static electric field between two ends of the chain. The interplay between charge inhomogenities and electric field induced polarization will be discussed in a number of cases. We will also show that none of these transitions follow Landau-Zener mechanism. I shall also discuss our theoretical proposal for the experimental strategies to stabilize highly unstable and reactive metal clusters like  $Al_4Li_4$  and their analogs.

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