

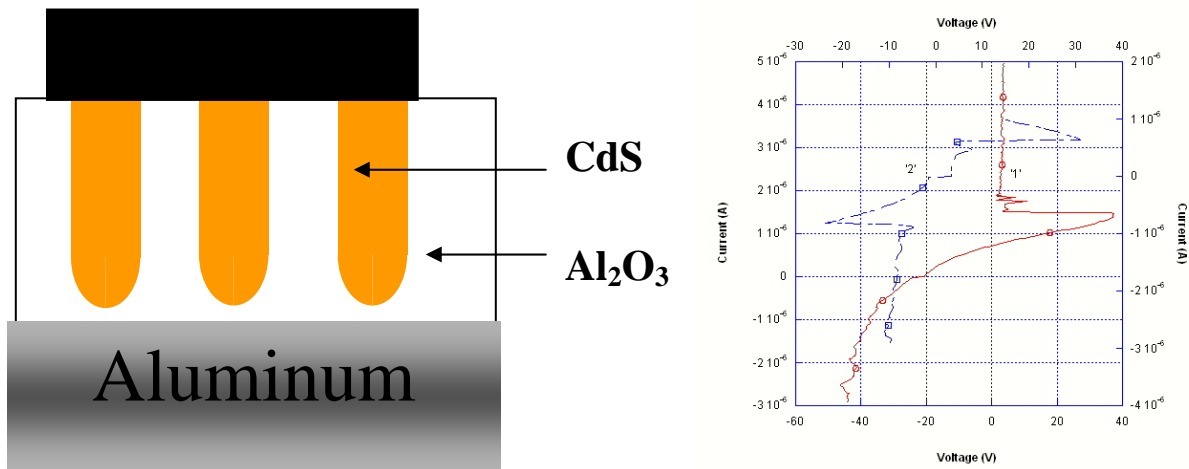
## NANO HIGHLIGHT

### Collective Computation with Self Assembled Quantum Dots, Nanowires and Nanodiodes: A Novel Paradigm for Nanoelectronics

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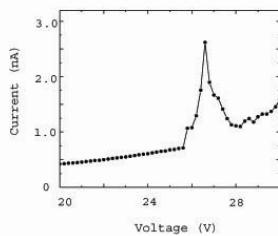
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The purpose of this project is to develop self assembled networks of interacting quantum dots, nanowires and nanodiodes for collective computation [1-3]. One of the primary requirements to elicit computational activity is that the nanowires exhibit a negative differential resistance. We have recently self assembled nanowires in a metal-insulator-semiconductor diode configuration, hosted in a nanoporous ceramic matrix. The cross section of the structure is shown below



This structure exhibits an S-type non-linearity with a pronounced negative differential resistance as shown in the right panel. The room temperature peak to valley ratio is 19:1. That makes these structures eminently suitable for the proposed architecture.

We have also observed N-type negative differential resistance in some nanowires. The peak to valley ratio associated with the N-type characteristics is smaller (2.5:1), but adequate for the circuit paradigm to work. The N-type characteristic is shown below.



(a)

#### References

1. V. P. Roychowdhury, D. B. Janes, S. Bandyopadhyay and X. Wang, IEEE Trans. Elec. Dev., **43**, 1688 (1996).
2. V. P. Roychowdhury, D. B. Janes and S. Bandyopadhyay, Proc. IEEE, **85**, 574 (1997).
3. K. Karahaliloglu, S. Balkir, S. Bandyopadhyay and S. Pramanik, IEEE Trans. Elec. Dev., **50**, 1610 (2003).