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Single-Electron Spectroscopy of Quantum Dots using Vertically Self-aligned Electrode Structure. RAMKUMAR SUBRAMANIAN, PRADEEP BHADRACHALAM, VISHVA RAY, SEONG JIN KOH, The University of Texas at Arlington — We demonstrate single-electron tunneling spectroscopy of individual quantum dots using new vertical electrode structure, where the source and drain electrodes are vertically self-aligned and separated by a thin dielectric spacer. A quantum dot placed on the periphery between the source and the drain electrodes forms a double barrier tunnel junction, allowing for single-electron spectroscopy measurements. CMOS compatible fabrication allows many quantum dot units to be fabricated in parallel processing. This technique not only provides an accurate electronic structure of a "single" quantum dot, but such measurement can be made for many of individual quantum dot units fabricated in a single batch process. Thus, this simple procedure provides accurate energy level measurement of "single" quantum dots over the entire quantum dot population. The band gap (E_g), charging energy (E_c) and energy level spacing (ΔE) were measured directly from the current-voltage and differential conductance spectra for colloidal CdSe quantum dots ($\sim$6.5nm). The band gap was measured to be E_g $\sim$1.75-1.85eV, charging energy E_c $\sim$60meV and the 's' to 'p' level separation (ΔE) was measured to be $\sim$60-100meV. (Supported by NSF CAREER (ECS-0449958), ONR (N00014-05-1-0030), and THECB ARP (003656-0014-2006)).

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