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Carrier Localization in Confined Vanadate Superlattices CRAIG EATON, LEI ZHANG, ROMAN ENGEL-HERBERT, Penn State University — Perovskite oxide heterostructures have attracted attention due to the wealth of phenomena emerging at the interface, as well as the presence of strong electron correlations with potential applications as active electronic material for logic application utilizing the metal-to-insulator transition. Successful monolithic integration of perovskite oxides with Si makes them an ideal material choice. Here we present the growth of cubic $SrTiO_3/SrVO_3/SrTiO_3$ heterostructures on $(La_{0.3}Sr_{0.7})(Al_{0.65}Ta_{0.35})O_3$ substrates and orthorhombically distorted $CaTiO_3/CaVO_3/CaTiO_3$ heterostructures on $(LaSrAlTa_4)O_3$ substrates by hybrid molecular beam epitaxy, where alkaline earth metals were supplied using conventional effusion cells and the transition metals from the metal-organic precursor titanium-isopropoxide and vanadium oxi-tri-isopropoxide. Here, the interfaces are non-polar and carrier confinement in the correlated vanadate metals (d^1 configuration, 1 electron per unit cell) is achieved using insulating titanates as barrier material. Growth challenges associated with optimizing conditions for cation and oxygen stoichiometry are discussed. Confined structures down to 2 ML have been studied to demonstrate the potential for tuning incipient 2D Mott transition from 3D correlated metal. Room temperature hall measurements revealed carrier concentration in $SrVO_3$ films are 2×10^{22} cm^{-3} in thick films and decreases to 8×10^{20} cm^{-3} at 3 ML confinement, revealing the onset of strong carrier localization. Direct comparison between $SrVO_3$ and $CaVO_3$ structures are presented to elucidate the role of dimensional confinement and structural distortion.

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