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Band gap engineering in digital manganite-titanate superlattices[1]

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The electronic structure of short period digital superlattices of two different phases depends strongly on the superlattice architecture. We have fabricated digital superlattices of super cells consisting of N layers of $LaMnO_3$ and N layers of $SrTiO_3$, N=1, 2, 3, 8, and measured their optical conductivities to probe the way in which the electronic structure depends on N. We found the valence band structure systematically changes, as N decreases, from bulk like band gaps to interface modified band gaps. The temperature dependence of the derived Mn Jahn-Teller/Mott gap in large period superlattices is completely different from the small period, suggesting different spin ordering states reside in them. The electronic structure of two parent materials are coherently blended at the interface, and the spin ordering is strongly modified. This method of producing meta materials is a promising new way of material engineering.

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