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Infrared dielectric properties and optical magnetoconductivity of $CaRuO_3/CaMnO_3$ superlattices A.V. BORIS, P. YORDANOV, P. POPOVICH, B. KEIMER, Max Planck Institute for Solid State Research, Stuttgart, Germany, J.W. FREELAND, Argonne Nat. Lab., J. CHAKHALIAN, Univ. of Arkansas, Fayetteville, H.N. LEE, Oak Ridge Nat. Lab. — Spectroscopic ellipsometry and magneto-reflectivity in the far-infared spectral range is used to study the electronic properties of $[(CaRuO_3)_N|(CaMnO_3)_{10}]_6$ superlattices (SLs). The nonlinear regression procedure is employed to extract the dynamical conductivity and dielectric permittivity of bare SLs within the effective medium approximation with a mixture of the ruthenate and manganite layers. We find that the infrared conductivity of the SLs decreases with decreasing individual ruthenate layer thickness, so that the effective number of conducting electrons per Ru atoms remains independent of N and is comparable with the bulk value even for ultrathin $CaRuO_3$ layers (N = 4-10 unit cells). This implies no major charge transfer effects between non-Fermi liquid metal $CaRuO_3$ and antiferromagnetic insulator $CaMnO_3$. While the low-energy electrodynamics of the SLs is governed by $CaRuO_3$ layer behavior, we find a negative magnetoresistivity at temperatures below $\sim$ 150 K, which correlates with the Neel temperature of the AFM state in $CaMnO_3$. The magnetoresistivity effect is discussed to be due to the strong spin dependent scattering from the interface.

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