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The Metal-Insulator Transition in Metal Transition Granular Films N.E. MASSA, Lanais EFO-CEQUINOR, U.N.L.P., C. C. 962, (1900) La Plata, Argentina, J.C. DENARDIN, Depto de Fisica, USACH, Santiago, Chile, L. SOCOLOSKY, M. KNOBEL, Inst de Fisica, UNICAMP, 13083-970, Campinas-SP, Brazil, X.X. ZHANG, Inst. of Nanoscience and Technology, UST, Hong Kong, China
— We study with infrared reflectivity the concentration and temperature dependence of the regime change from metallic to insulating in granular films made of transition metals embedded in SO_2. The $TM_x(SO_2)_{1-x}$ (TM=Fe, Ni, Co), ($0.25 \leq x \leq 0.85$) systems yield spectra typical of conducting oxides where hopping carriers undergo electron-phonon interactions with localization enhanced by nanoparticles and substrate roughness. The distinct Drude component, extending beyond 1.3 eV in the metallic state, undergoes a dramatic change in intensity due to the progressive reduction of carriers critical paths as the transition temperature is reached in the glassy matrix. At the intermediate conducting state for $x \sim 0.55$, about the percolation threshold, a well defined reflectivity edge and band, considered fingerprint for small polarons, emerges in addition to the vibrational bands. A very good agreement is found between the measured optical conductivity and current small polaron models. This, in addition to underlying the importance of polarization effects, provides grounds toward a quantitative microscopic description of transport properties. It also adds toward an understanding of a non-magnetic factor in the magnetoresistance and extraordinary Hall coefficient enhancements.

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