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【170】Evolution of Electron-Phonon Coupling across the Metal-Insulator Transition of Rare-Earth Nickelates

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Rare-earth nickelates, $RNiO_3$, are negative charge-transfer materials with electronic configuration of Ni-$3d^8\underline{L}$ ($\underline{L}$ = oxygen ligand hole) in their metallic state. Most $RNiO_3$ undergo low-temperature metal-to-insulator transition (MIT) accompanied by breathing distortion in their crystal structure, where neighboring expanded NiO_6 octahedra (Ni-$3d^8$ configuration) alternate with collapsed NiO_6 (Ni-$3d^8\underline{L}^2$). Here, using resonant inelastic x-ray scattering, we reveal that the electron-phonon coupling (EPC) of the breathing-mode phonon significantly increases as $NdNiO_3$ undergoes MIT. Meanwhile, no significant changes are observed in the EPC of $LaNiO_3$ ($SmNiO_3$), which stays metallic (insulating) at all studied temperatures. These results confirm the major role that the breathing distortion and its EPC play in the MIT of $RNiO_3$.

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