Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Optical Properties of Na_xCoO_2 Single Crystals ($0.20 \leq x \leq 0.85$)
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— We present in-plane optical measurements over broad frequencies on NaxCoO2 single crystals with $0.20 \leq x \leq 0.85$.[1] We found that the spectral weight associated with the conducting carriers increases systematically with decreasing Na contents. The evolution suggests against a picture of doped Mott insulator for the NaxCoO2 system. At high energy, two broad interband transition peaks near 1.5$\sim$1.6 eV and 3$\sim$3.1 eV were observed. For metallic samples, anomalous charge dynamics was revealed at low frequencies. A peak at finite frequency is commonly observed, which shifts to higher frequencies with increasing temperature, irrespective of a positive slope of the dc resistivity. In addition, the optical spectra reveal a combination of the coupling effect of electrons with a Boson mode and pseudogap-like phenomenon. For the charge ordering sample of x=0.5, a broad hump near 800 cm^{-1} develops below around 100 K. Upon entering the charge- ordering state, a sharp suppression of the spectral weight is seen near 230 cm^{-1}, indicating the opening of a charge gap.
[1] N. L. Wang, et al., Phys. Rev. Lett. 93, 147403 (2004); ibid, 93 (issue of Dec.3, in-press) (2004).

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Date submitted: 01 Dec 2004 Electronic form version 1.4