

Optical Study of the Pseudogap State in $\text{YBa}_2(\text{Cu}_{1-x}\text{Zn}_x)\text{O}_{7-\delta}$

Tuesday, 24 July 2012 20:00 (2 hours)

Ece UYKUR

Department of Physics, Graduate School of Science, Osaka University, Osaka 560-0043, JAPAN

Takahiko MASUI

Department of Physics, Graduate School of Science, Osaka University, Osaka 560-0043, JAPAN

Kiyohisa TANAKA

Department of Physics, Graduate School of Science, Osaka University, Osaka 560-0043, JAPAN

Shigeki MIYASAKA

Department of Physics, Graduate School of Science, Osaka University, Osaka 560-0043, JAPAN

Setsuko TAJIMA

Department of Physics, Graduate School of Science, Osaka University, Osaka 560-0043, JAPAN

It has been shown that the c-axis optical spectra of the high-T_c cuprate superconductors are sensitive to the antinodal region of the Fermi surface that is reflecting the strong effects of the pseudogap. Unlike the other spectroscopic techniques, the optical spectra can in principle distinguish the pseudogap and the superconducting condensation, based on the behavior of the spectral weight transfer. However, in reality, the additional structures such as the transverse Josephson plasma (TJP) mode [1] in the c-axis spectra of the $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ make the discussion difficult and complicated. In this study, we carried out the temperature dependent c-axis reflectivity measurements on the Zn-substituted $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ single crystals, where the additional anomalies in the spectra were suppressed with the Zn-doping [2]. In the absence of the TJP resonance mode, we have observed the continuous transfer of the low energy spectral weight to the higher energy region even below T_c as the response of the pseudogap. This is the evidence of the coexistence of the pseudogap and the superconducting gap, suggesting an inhomogeneous state. Furthermore, we found an unexpected Zn-effect, the disappearance of the change in kinetic energy at the superconducting transition which is pronounced in the underdoped regime. This might be due to the weakening of the carrier confinement by Zn-doping [3,4].

[1] C. Bernhard et al., Phys. Rev. B 61, 618 (2000)

[2] R. Hauff et al., Phys. Rev. Lett. 77, 4620 (1996)

[3] T. Masui et al., Advances in Superconductivity XII (Springer-Verlag) pp. 221 (2000)

[4] K. Tomimoto et al., Phys. Rev. B 60, 114 (1999) ; S. Tajima et al., J. Low Temp. Physics 117, 413 (1999)

Primary author: UYKUR, Ece (Department of Physics, Graduate School of Science, Osaka University)

Presenter: UYKUR, Ece (Department of Physics, Graduate School of Science, Osaka University)

Session Classification: Poster Session 2

Track Classification: High-T_c Cuprates