Study on Electronic Structure and Electron-phonon Coupling of Spinel Oxide Superconductor $LiTi_2O_4$

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As a spinel superconductor with the highest transition temperature, $LiTi_2O_4$ has been extensively studied over the past 50 years due to its various novel properties, such as spin-orbital fluctuations, mixed valences of Ti^{3+} and Ti^{4+}, d-d electron correlation.[1-3] Recently, angle-dependent magnetoresistance measurements have shown that below the superconducting transition Tc, $LiTi_2O_4$ thin films display anisotropic magnetoresistance signals, indicating that $LiTi_2O_4$ may be a candidate for d-wave superconductors[4]. Tunneling spectra shows different boson modes at different termination surfaces in the $LiTi_2O_4$ thin films, which are thought to have electron phonon coupling anisotropy in this material[5]. Until now the superconductivity mechanism of $LiTi_2O_4$ remains unresolved. In this study, $LiTi_2O_4$ thin films with atomically flat surfaces have recently been synthesized using pulsed laser deposition (PLD). We have used in-situ measurements for the first time to obtain the complete electronic structure and ultra-low temperature tunneling spectrum of $LiTi_2O_4$. We determined the electronic structure, the electron-electron correlation and the energy gap structure of LTO. We discovered a remarkably strong and anisotropic electron phonon coupling in this material. These observations shed light on the superconductivity mechanism of $LiTi_2O_4$, indicating that it behaves as a BCS superconductor with an anisotropic electron-phonon coupling strength, which is important for understanding this system.

References

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