Laboratory-based *in-situ* photoemission spectroscopy of quantum material epitaxial films

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Epitaxial film technology allows us to design and control the physical properties of quantum materials beyond the bulk properties. It also makes it possible to investigate materials that have been difficult to synthesize their bulk single crystals by such as angle-resolved photoemission spectroscopy (ARPES). To reveal the electronic states of exotic quantum material epitaxial films, we have constructed a so-called vacuum cluster system where a pulsed laser deposition (PLD) system and an APRES system are connected under ultra-high-vacuum (see **Figure 1a**)[1,2]. In this talk, I'd like to introduce one of the recent studies on an oxide superconductor, $LiTi_2O_4$ (LTO).

LTO is a unique spinel oxide with a high superconducting transition temperature of 13 K (see **Figure 1b**). While it is expected to have intimate relation between superconductivity and orbital degree of freedom, less is understood about this material because large size single crystal has not been available. Recently, epitaxial film growth using PLD has been reported [3]. However, direct observation of the electronic structure by APRES has not been accomplished.

This work presents the first observation of the band structure of LTO (111) thin films grown by PLD. The hexagonal Fermi surface with corners on the Brillouin zone corner implies that a saddle point exists near the Fermi energy (E_F). The band dispersion shows a distinct kink structure at 50 meV below E_F, suggesting the enhanced many-body effects. Its temperature dependence reveals a phase transition around 150 K accompanied by the disappearance of the kink. We will discuss the origin in detail.

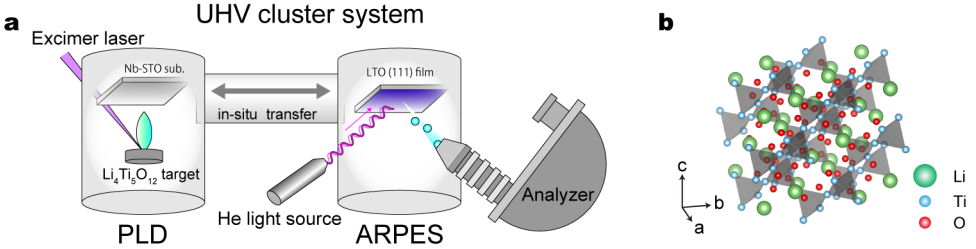

FIGURE 1. (a) Schematics of our UHV cluster system connecting the PLD and the ARPES systems under ultra-high vacuum. (b) Crystal structure of the spinel oxide superconductor $LiTi_2O_4$.

REFERENCES

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