Study on Epitaxial Ruthenium Oxide Thin Films

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Ternary Ruthenium oxides are widely studied for their unique properties. There exist charge, spin, phonon and spin-orbit coupling interactions and strong electronic correlations play an important role in *4d* electron systems. The members of the Ruddlesden-Popper series $Sr_{m+2}Ru_{m+1}O_{3m+4}$ present different properties. $SrRuO_3$ is known as a ferromagnetic metal while Sr_2RuO_4 is paramagnetic. The differences between the same series of compounds are intriguing. Maybe they are potentially related.

Separately, $SrRuO_3$ has attracted interest as a conducting layer in epitaxial heterostructures with a variety of functional oxides owing to its good conductivity. Besides, it should be mentioned that Sr_2RuO_4 is generally considered as a kind of spin-triplet superconductor and candidate material to realize topological superconductors and the search for Majorana fermions. However, relevant experiments should be carried on large-sized thin films with high quality.

We grow the thin films by oxide molecular beam epitaxy technology which can realize the control of high-purity strontium and ruthenium metals' evaporation independently in an oxygen atmosphere. Layer-layer growth mode is achieved through regulation of deposition rate ratio. We fabricate high quality and high precise stoichiometric ratio of $SrRuO_3$ and $SrRuO_4$ thin films with co-deposition and shutter-control growth modes respectively. Then angle-resolved photoemission spectroscopy is applied to study their electronic structures. Basing on the preliminary results, we will force on the $SrRuO_3$ 'sandwish' heterojunction growth and expect the realization of superconductivity of Sr_2RuO_4 epitaxial thin films.