

Heteroepitaxial Growth of High-Quality and Impurity-Free (00.1) CuFeO₂ Thin Films on Hexagonal (00.1) Sapphire and Cubic (100) SrTiO₃ Substrates by Pulsed Laser Deposition

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Abstract:

Recently, Cu⁺¹Fe⁺³O₂ thin films attract increasing research interests as a promising p-type narrow-band-gap semiconductor for potential application as thin film photocathode in solar water splitting cell for hydrogen production. High-quality and impurity-free CuFeO₂ epitaxial thin films would be preferable for fundamental studies on the physical and chemical properties. However, the heteroepitaxial growth of impurity-free CuFeO₂ thin films has been a significant challenge owing to its narrow formation window in Cu-Fe-O system as well as the metastable nature of the Cu¹⁺ cations. This work reports for the first time the fabrication and characterization of high-quality and impurity-free (00.1)-oriented CuFeO₂ epitaxial thin films grown on hexagonal (00.1) sapphire and cubic (100) SrTiO₃ substrates by using pulsed laser deposition. This study provides an insight into the heteroepitaxial growth of CuFeO₂ thin films with high purity and crystalline quality as an ideal sample design to characterize the fundamental properties of this material in view of potential device application.

References

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2. S. Luo, G. F. Harrington, D. Pergolesi, T. Ishihara, and T. Lippert. Heteroepitaxial Hexagonal (00.1) CuFeO₂ Thin Film Grown on Cubic (100) SrTiO₃ Substrate by Pulsed Laser Deposition. (2020) In preparation