Searching for Superconductivity in Ruthenate Thin Films Grown by Molecular Beam Epitaxy

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Introduction

Sr₂RuO₄ first garnered interest due to its shared structure with high temperature superconductor La₂₋ₓBaxCuO₄.

Although Sr₂RuO₄ did not display high temperature superconductivity, the possibility of it displaying spin-triplet, topological superconductivity is still debated.

Spin-triplet superconductors can be useful for quantum computing applications.

Experimental

Growth conditions were selected using the Ellingham diagram for Ba and Ru oxides.

We searched for the ideal growth conditions by attempting growth with various:

- Growth temperatures
- Oxygen pressures
- Ru/Ba flux ratios

All growths were performed on DyScO₃ (DSO) substrates oriented in the (110) direction.

Results

Single-phase Ba₂RuO₄ thin films isostructural to Sr₂RuO₄ can be successfully grown using molecular beam epitaxy.

Although the films can be grown, they do not display superconductivity. This is possibly due to impurities within the samples.

Impurities greatly reduce the superconducting critical temperature for Ba₂RuO₄ and often suppress superconductivity completely in ruthenates.

Conclusions

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References