Growth and Polymorphism of Insulating Delafossites

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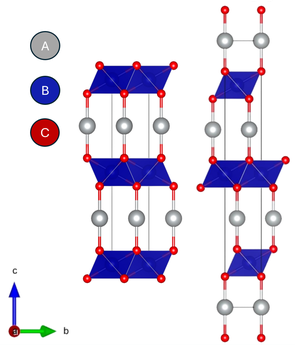
Abstract

- Silver cobalt oxide ($AgCoO_2$) is a less studied delafossite with promising electronic and energy related applications.
- This research aims to optimize the growth parameters of $AgCoO_2$ and investigate its compatibility with $PdCoO_2$ to assess its potential as a pseudosubstrate for other delafossites.
- Samples were grown using molecular beam epitaxy (MBE) and characterized with reflection high-energy diffraction (RHEED) imaging, X-ray diffraction (XRD) and atomic force microscopy (AFM).

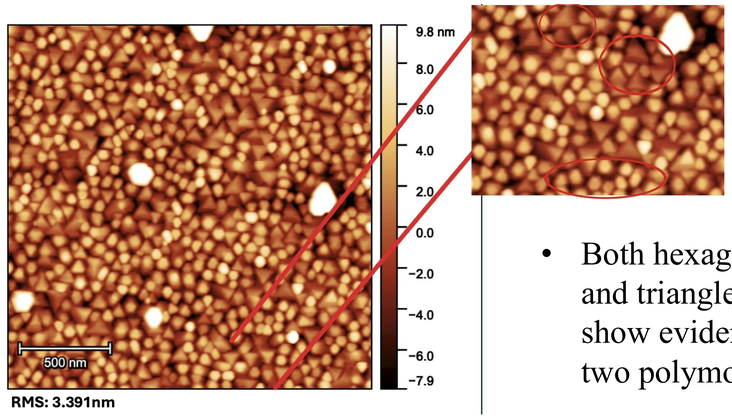


Introduction & Methodology

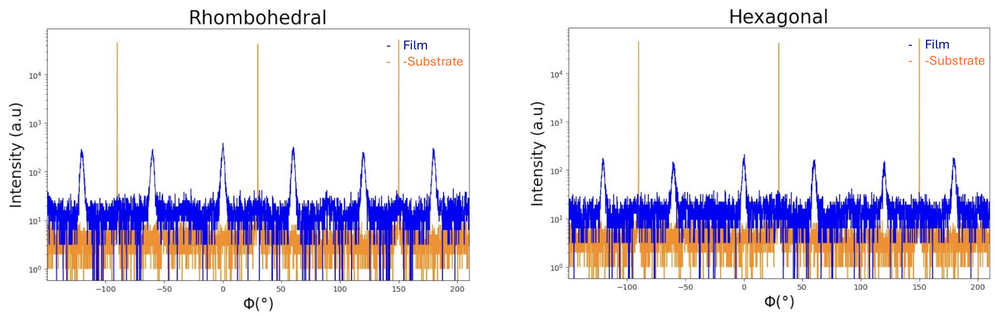
- Delafossites are layered materials with the general formula ABO_2 (1).
- They exhibit electronic and magnetic properties useful for various applications.
- Samples were grown using Molecular Beam Epitaxy (MBE) with the shutter growth method.

Results

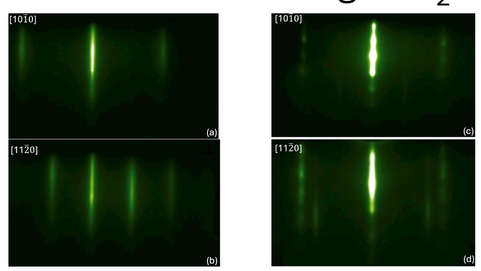
Thick Sample AFM and Phi Scans

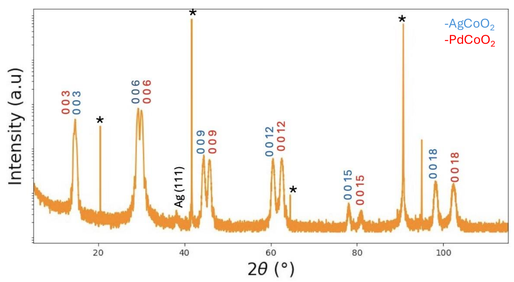


- Both hexagons and triangles show evidence of two polymorphs



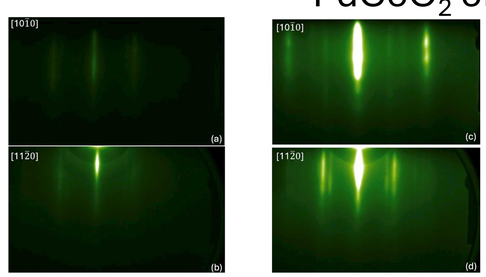
$AgCoO_2$ on $PdCoO_2$ Growth

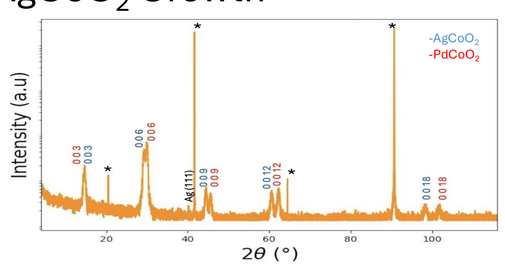




(a) and (b) RHEED images of $PdCoO_2$ showing sharp streaks typical of a delafossite structure. (c) and (d) RHEED images of $AgCoO_2$ grown on $PdCoO_2$, where the streaks appear bumpier indicating a slightly rougher film surface.

$PdCoO_2$ on $AgCoO_2$ Growth





(a) and (b) RHEED images of $AgCoO_2$ showing sharp streaks typical of a delafossite structure. (c) and (d) RHEED images of $PdCoO_2$ grown on $AgCoO_2$, where the streaks appear bumpier indicating a slightly rougher film surface

Conclusion

- Optimized growth conditions of $AgCoO_2$ and found that regardless of the amount of silver deprived, the samples remained insulating.
- Successfully interfaced $AgcCoO_2$ with $PdCoO_2$ in both growth orders, bringing us closer to using $AgCoO_2$ as a pseudosubstrate.
- Observed twinning and identified multiple polymorphs in our $AgCoO_2$.

Next Steps

- To improve the surface quality of our $AgCoO_2$ samples, to investigate interfacing it with other delafossites for use a template.
- Aim to stabilize polymorphs by enhancing substrate preparation.
- Introducing a slower growth rate to promote step-flow growth.

Acknowledgements

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References

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