

Nanoscale rock-salt structured high-entropy metal oxides for catalysis

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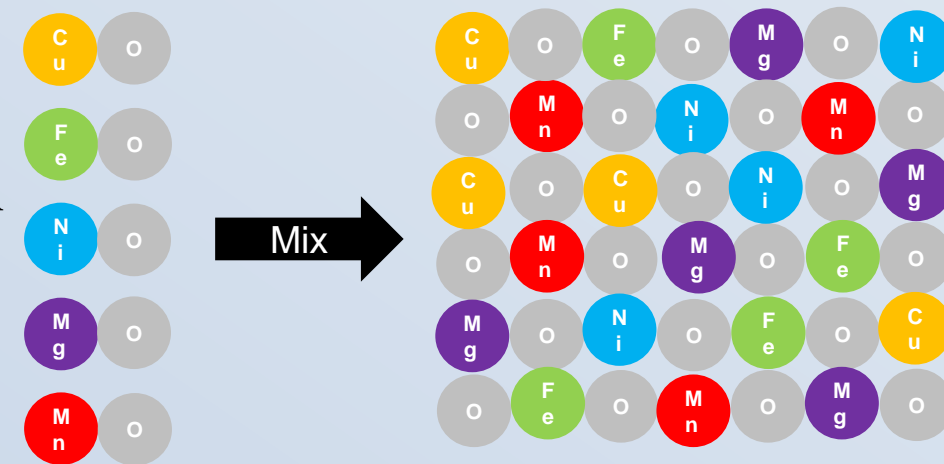
Colorado School of Mines Department of Chemistry



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I. Introduction

- High entropy oxide (HEO) materials are a new class of solids formed by configurational entropy generated by their multi-elemental composition [1]
- Due to the large range of multi-elemental configurations, it is possible to tune the chemical and physical properties for specific electronic and catalytic purposes [1]
- HEOs are typically formed with a top-down technique which offers little control over morphology [1]



II. Experimental Design

Precursors



Autoclave



20 minutes
Mixed

Centrifuged



4 hours at 100 °C

Drying

Tube Furnace



950 °C for 1 hour

Calcined

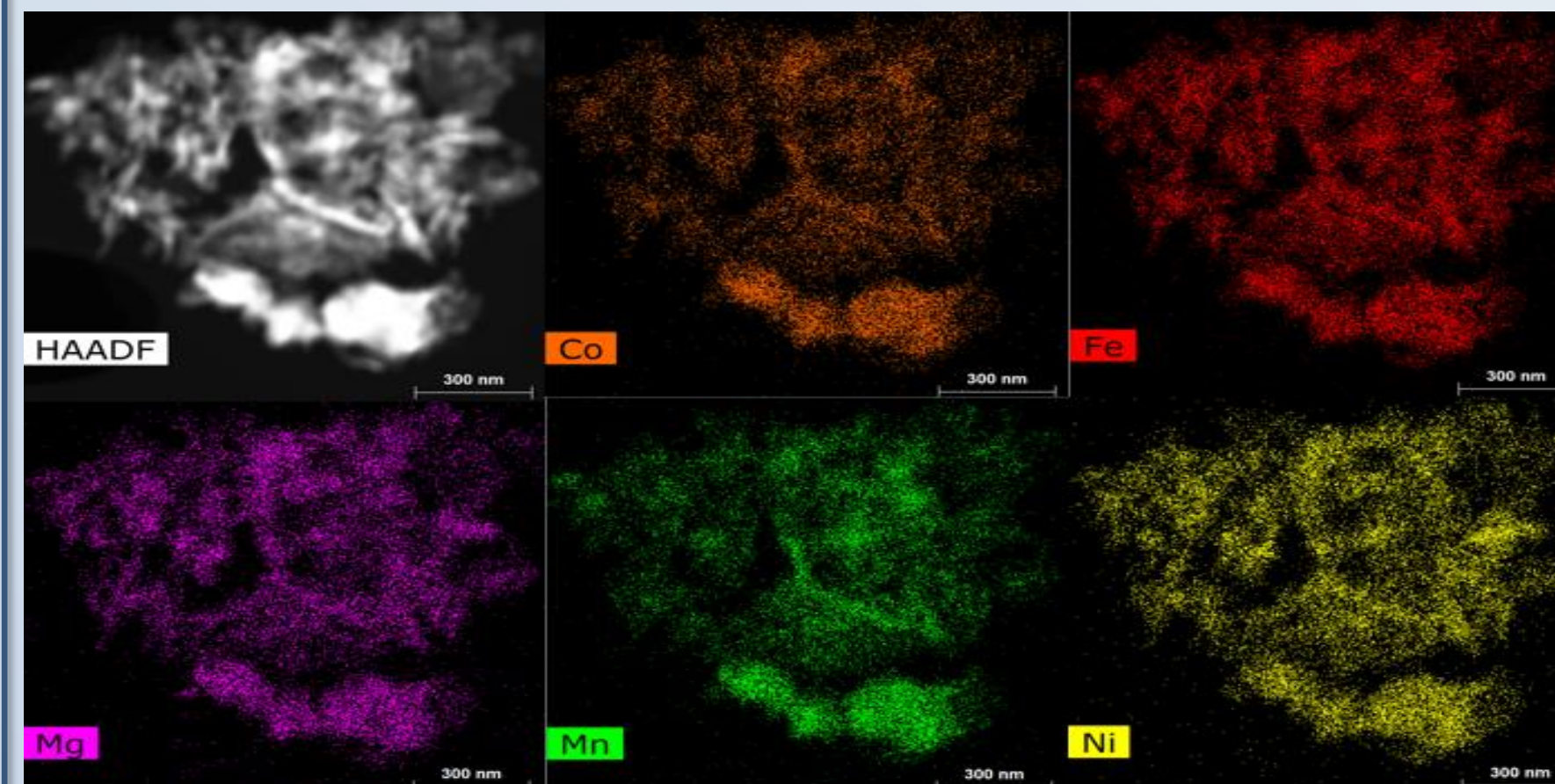
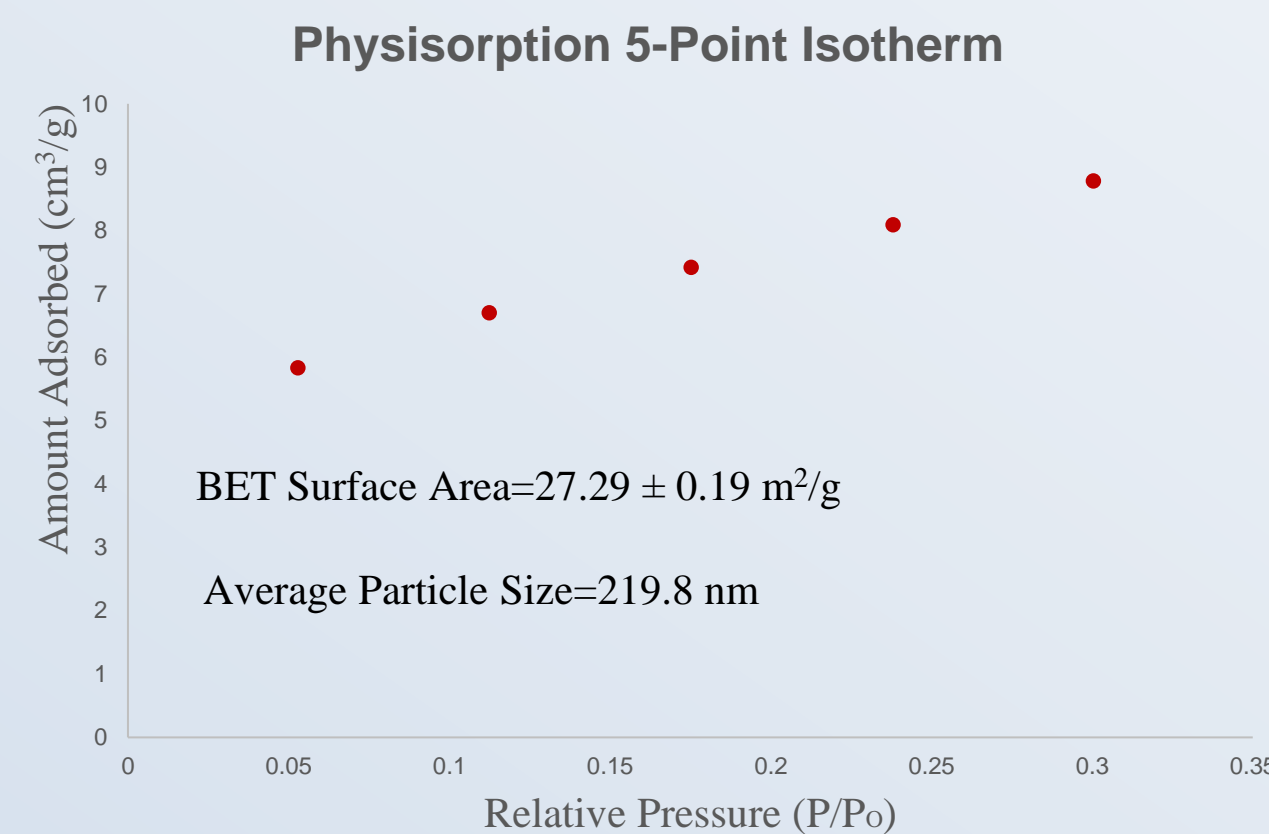
Mortar and pestle



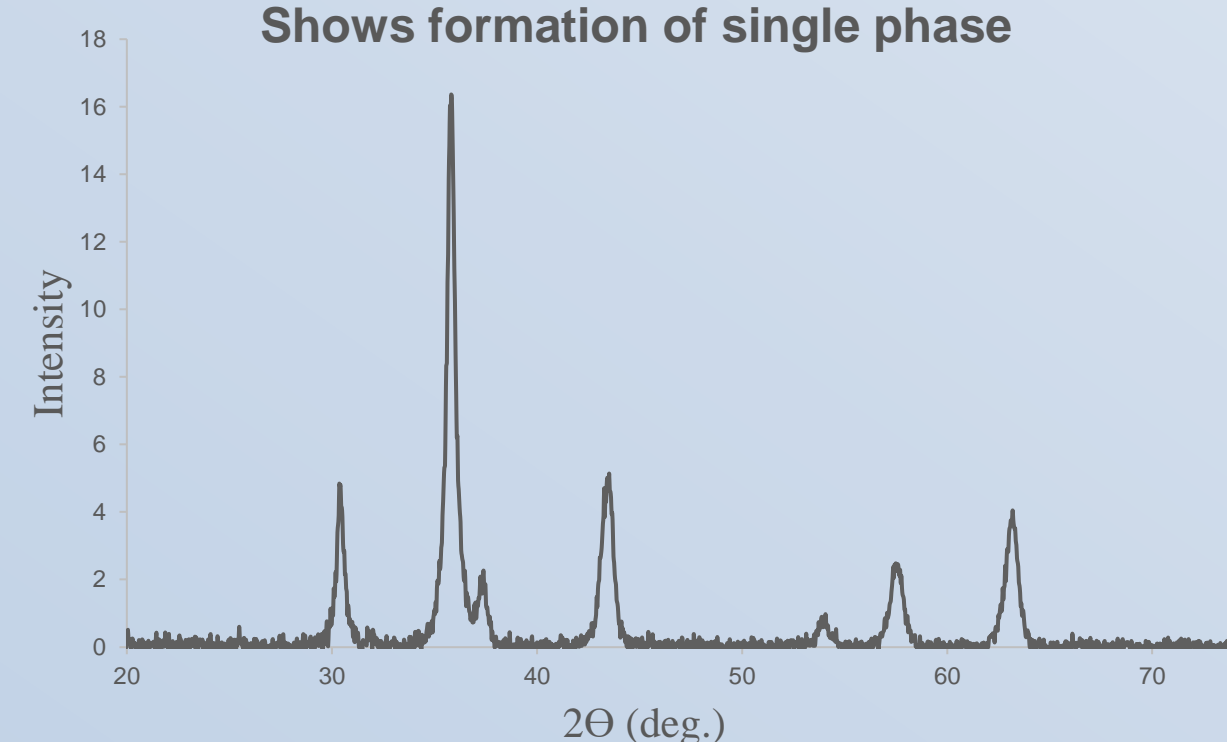
Characterized
Physisorption, TEM-EDX, and PXRD

III. Characterization

- Nitrogen Physisorption
- Energy Dispersive X-ray Spectroscopy
- Powdered X-Ray diffraction



Powder X-Ray Diffraction Shows formation of single phase



IV. Conclusion

- This research focused on the wet chemical synthesis of HEOs with rock-salt structure, made from earth-abundant and inexpensive precursor metals
- The ability to control the structure of this class of materials on the nanoscale remains a challenge
- Tailoring (porosity, morphology) this class of materials offers a path toward using earth-abundant systems to replace rare and expensive metals such as platinum, iridium, and rhodium in renewable energy applications

V. Future Work

- Catalytic performance test with electrochemical characterization (cyclic voltammetry, linear-sweep voltammetry, stability tests)
- Using wet-chemical techniques to see their effect on size, shape, structure, and function

VI. Acknowledgements



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VII. Reference

- [1] Albedwawi, S. H.; AlJaberi, A.; Haidemenopoulos, G. N.; Polychronopoulou, K. High Entropy Oxides-Exploring a Paradigm of Promising Catalysts: A Review. *Materials & Design* **2021**, *202*, 109534.