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Metal-Oxide Frameworks-based Cobalt Oxides as Efficient Electrocatalysts

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Overview

- Green energy production via cost-effective ways is one of the main requirements in current days.
- Efficient electrocatalysts are needed to produce a green energy, such as hydrogen.
- Metal-organic frameworks (MOFs)–based materials can become a good candidate for electrocatalysts due to a large surface area and abundant active sites.
- Reaction temperature is an important factor to tune the structure and morphology of the materials, resulting in the different electrocatalytic activities.
- Co-MOF materials were synthesized at the various temperatures to improve the efficiency of the water splitting process.

Application

$2\,H_2O \rightarrow 2\,H_2 + O_2$

Water Splitting

Fuel cell vehicles

Oxygen tank

Experimental

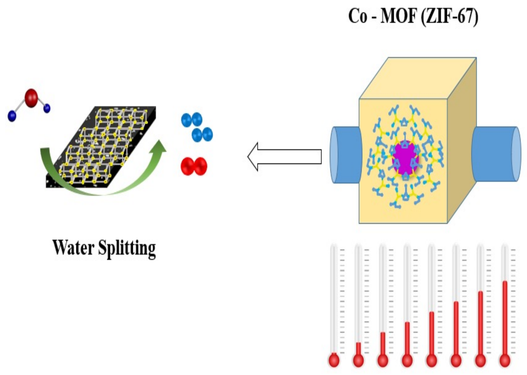


Figure: Schematic of the synthesized materials at various annealing temperatures for energy storage and production

Morphology

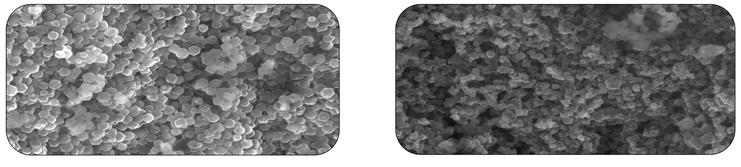
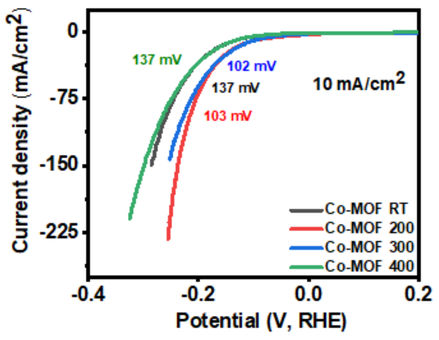


Figure: the morphology of Co-MOF 400 and 500 materials

Results and Discussion



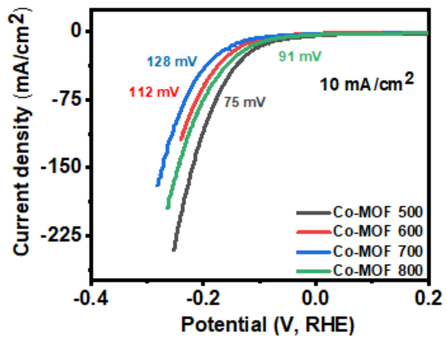


Figure: HER polarization curves for Co-MOF RT-800 °C electrode

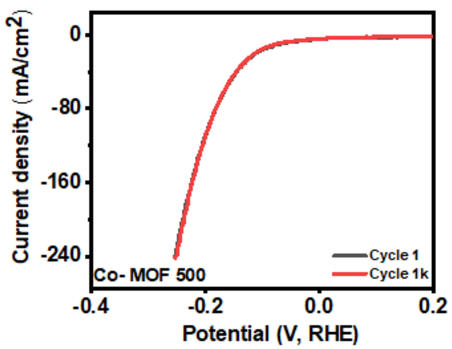
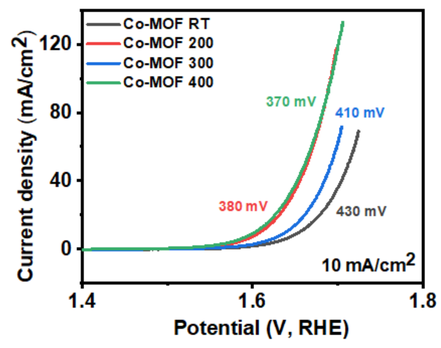


Figure: 1 and 1k HER polarization curves for Co-MOF 500



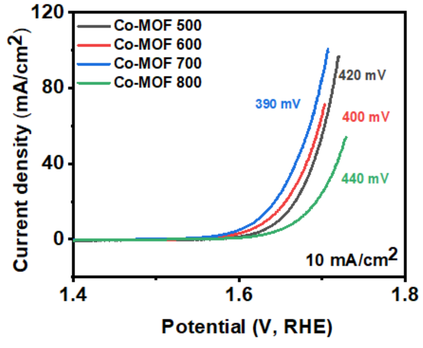


Figure: OER polarization curves for Co-MOF RT-800 °C electrode

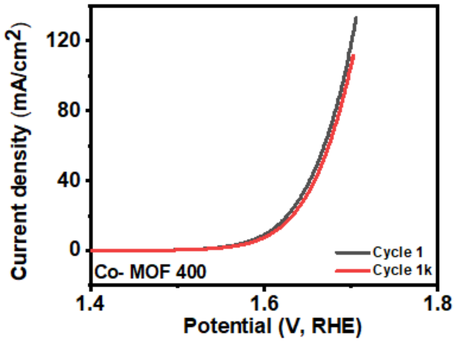


Figure: 1 and 1k OER polarization curves for Co-MOF 400

Conclusion

- Metal-oxide frameworks-based cobalt oxides were synthesized at the various temperature (RT – 800 °C).
- The Co-MOF electrodes showed low overpotential in the range of 75 to 137 mV to achieve a current density of 10 mA/cm^2.
- The Co-MOF electrodes required an overpotential in the range of 370 to 440 mV for oxygen production at 10 mA/cm^2.
- These materials showed stable performance for up to 1,000 cycles of cyclic voltammetric studies.

Future Research

- Future research focuses on making an electrolyzer to test the performance of electrodes at the two-electrode system.

Acknowledgement

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