CeFEMA
Center of Physics and Engineering of Advanced Materials

ENCONTRO COM A CIÊNCIA E TECNOLOGIA EM PORTUGAL
16 a 18 MAIO 2022
#ciencia2022PT

Improved oxygen electrode performance using polyoxometalates for rechargeable metal-air batteries

Teodora Đurić[a], Filipe M.B. Gusmão[b], Jadranka Milikić[a], Dalibor Stanković[c,d], Nemanja Gavrilov[a], Diogo M.F. Santos[b], Biljana Šljukić[b,*]

[a]*University of Belgrade, Faculty of Physical Chemistry, Belgrade, Serbia*
[b]*CeFEMA, Instituto Superior Técnico, Universidade de Lisboa, Lisbon, Portugal*
[c]*University of Belgrade, Faculty of Chemistry, Belgrade, Serbia*
[d]*University of Belgrade, Vinča Institute of Nuclear Sciences, Vinča, Serbia*

**biljana.paunkovic@tecnico.ulisboa.pt*

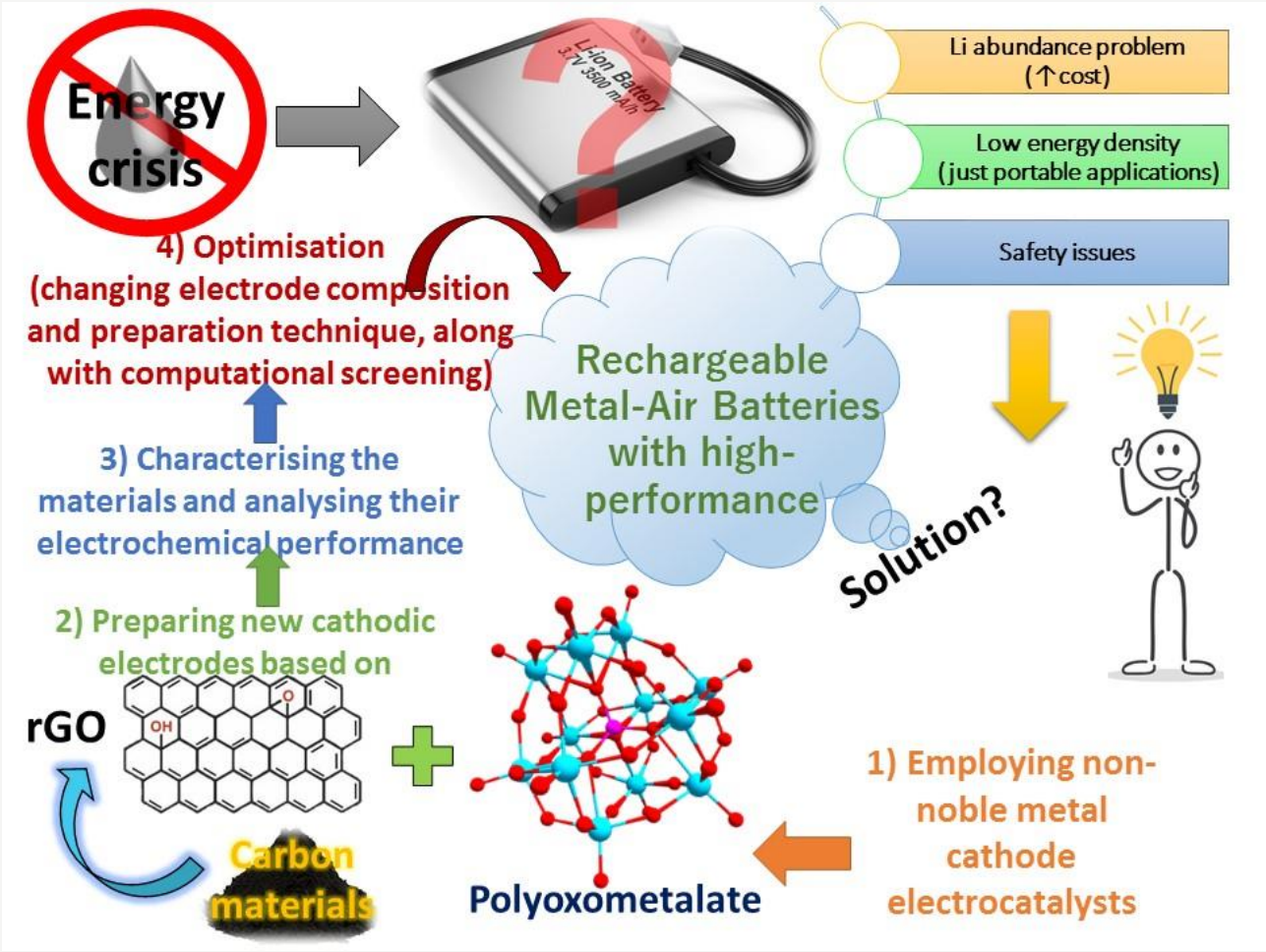
Tailoring polyoxometalates as next-generation electrocatalysts for rechargeable metal-air batteries, EXPL/EQU-EQU/0517/2021

Ciência 2022, May 16 - 18, 2022

Motivation

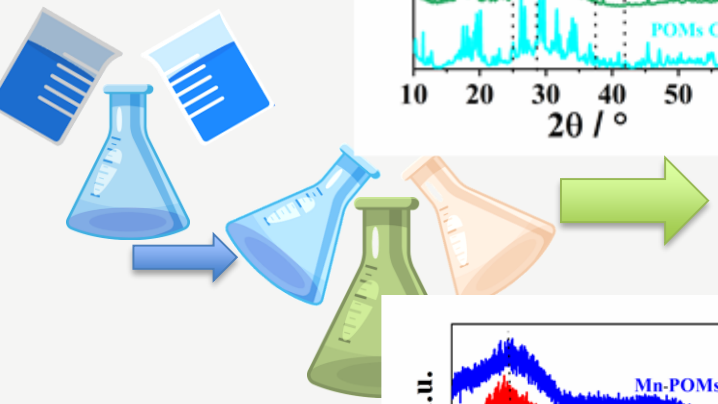
Solution for energy crisis

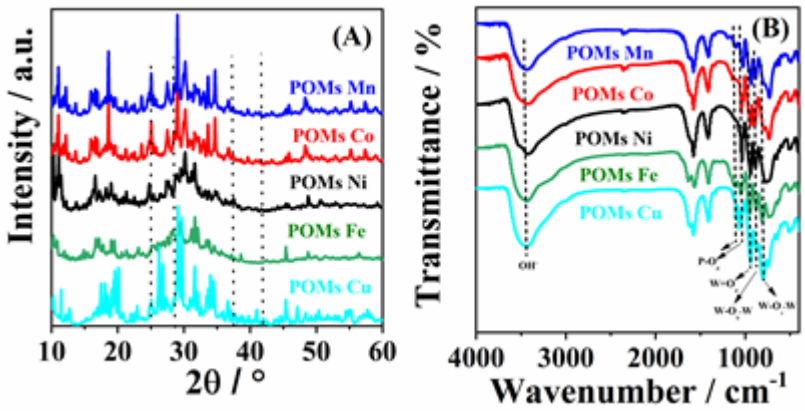
"Today's challenge is the design of an electrochemical technology that can perform safely the task of electrical-energy storage and recovery at a rate and cost that are competitive with the performance of the well-established fossil fuel technologies"

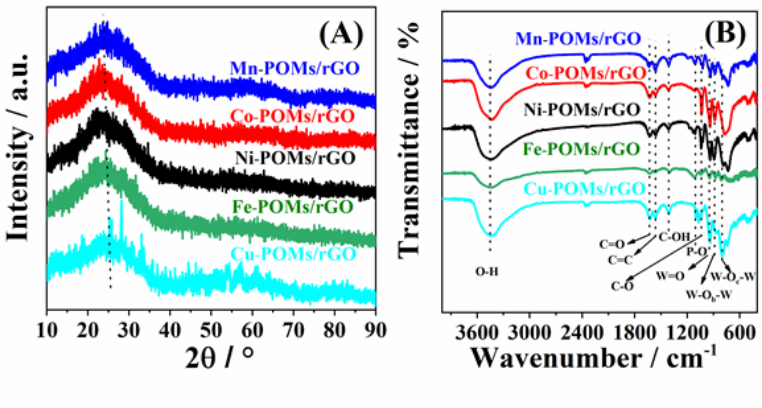


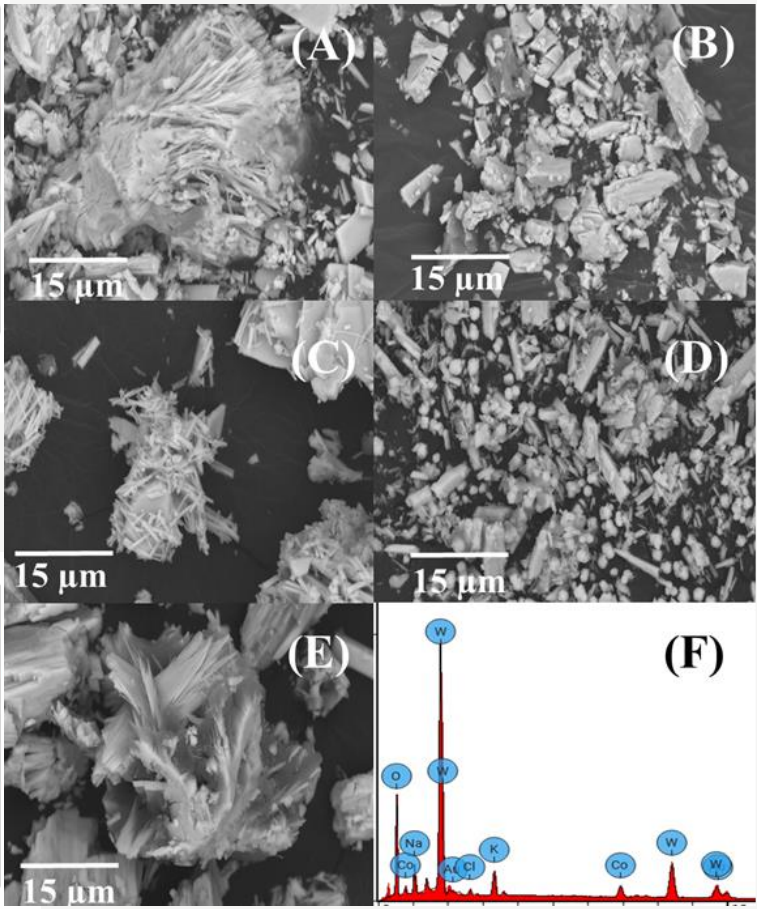
Results

Preparation and characterisation of POM/rGO







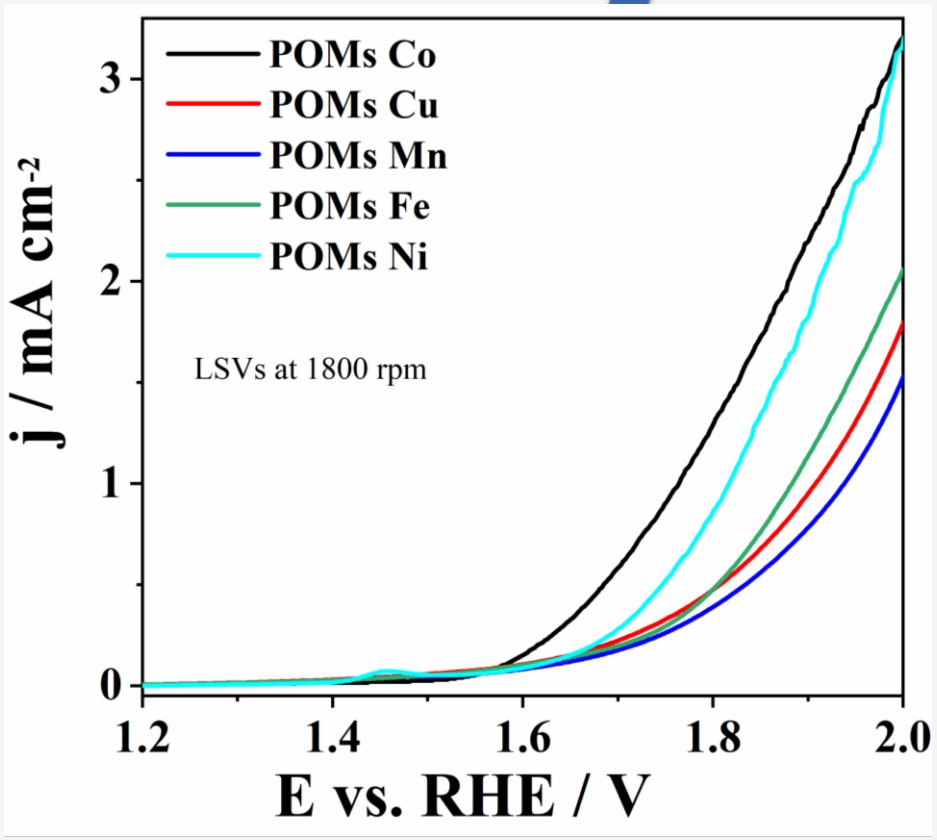


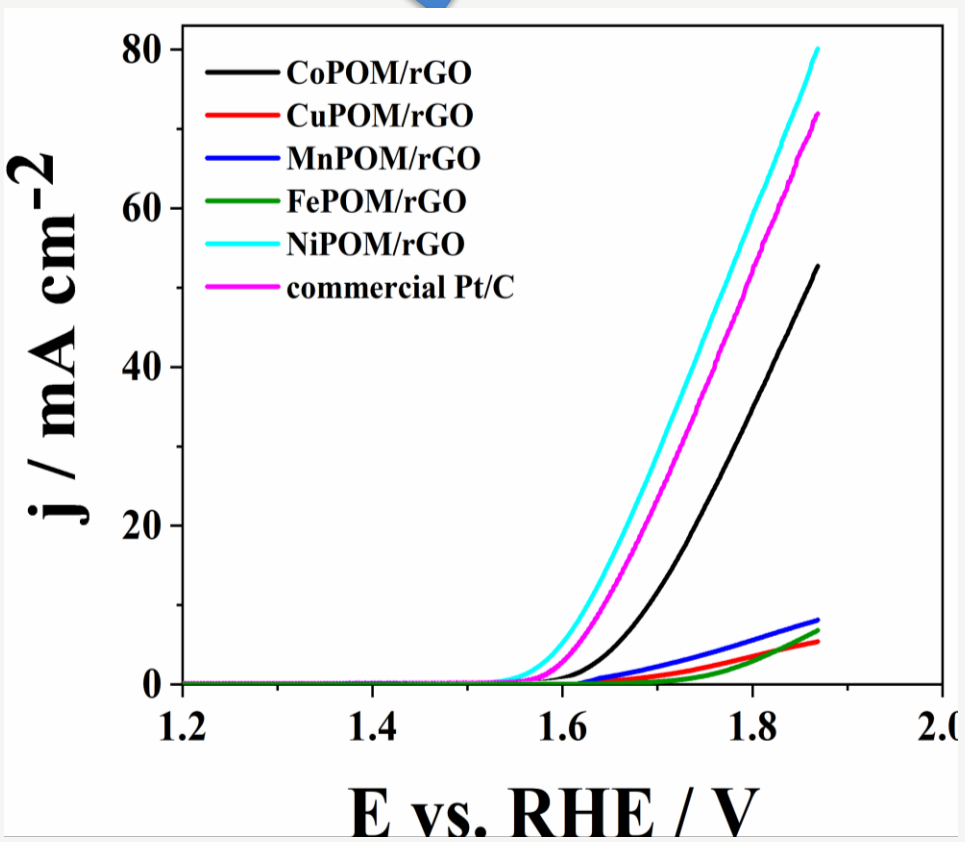
SEM images of POMs Ni (A), POMs Mn (B), POMs Fe (C), POMs Cu (D), and POMs Co (E) with EDS spectrum (F) of POMs Co

Results

Oxygen evolution reaction: voltammetric study

+ rGO

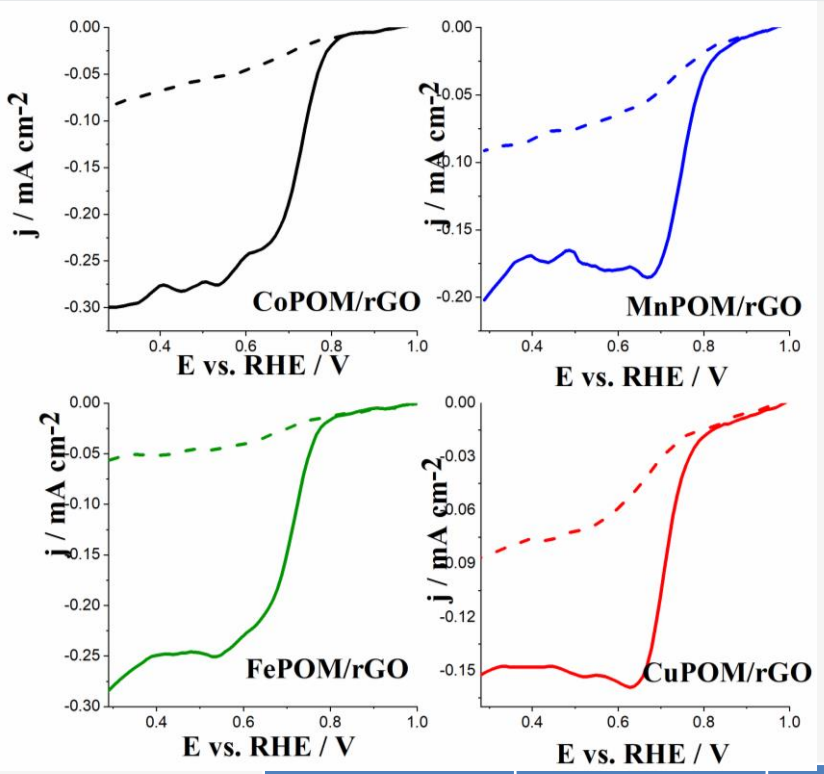


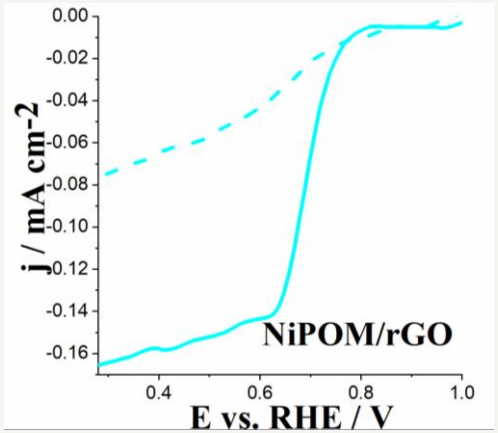


$4OH^-_{(aq)} \leftrightarrow 2H_2O_{(l)} + O_{2(g)} + 4e^-$ $E^0 = 0.40$ V vs. SHE

Results

Oxygen reduction reaction: voltammetric study





$$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-; E^0 = +0.401V$$

$$O_2 + H_2O + 2e^- \rightarrow HO_2^- + OH^-; E^0 = -0.065V$$

$$HO_2^- + H_2O + 2e^- \rightarrow 3OH^-; E^0 = +0.867V$$

$$2HO_2^- \rightarrow 2OH^- + O_2$$

Material	b (V/dec)	n	j_d (mA/cm²)	E_{onset} (V)	$E_{1/2}$ (V)
CoPOM/rGO	-0.168	2.2 – 2.3	-0.926	0.767	0.677
MnPOM/rGO	-0.180	1.7 - 1.9	-0.661	0.765	0.678
FePOM/rGO	-0.176	1.6 – 1.8	-0.934	0.746	0.658
CuPOM/rGO	-0.154	2.1 - 2.4	-0.816	0.737	0.639
NiPOM/rGO	-0.175	1.7 – 1.8	-0.810	0.719	0.620

Future work

What is next?

- Different ratio of POM and rGO
- Bimetallic POMs
- Stability tests
- Battery tests

Acknowledgments

- Fundação para a Ciência e a Tecnologia - **Tailoring polyoxometalates as next-generation electrocatalysts for rechargeable metal-air batteries, EXPL/EQU-EQU/0517/2021**
- Fundação para a Ciência e a Tecnologia (contract no. IST-ID/156/2018, B. Šljukić).
- Ministry of Education, Science and Technological Development of the Republic of Serbia (contract no. 451-03-68/2022-14/200146)