Área: MAT

High-entropy metal-glycerolate as a precursor template of spherical porous high-entropy oxide microparticles

Josué M. Gonçalves (PG),[1,2*] Alireza Ghorbani (PG),[1] Timothy G. Ritter (PG),[3] Irlan S. Lima (PG),[2] Mahmoud Tamadoni Saray (PG),[1] Abhijit H. Phakatkar (PG),[4] Vinicius D. Silva (PG),[1] Rafael S. Pereira (PG),[5] Alexander L. Yarin (PQ),[1] Lúcio Angnes (PQ) [2] and Reza Shahbazian-Yassar (PQ)[1*]

josuemartins@usp.br; rsyassar@uic.edu

[1]*Department of Mechanical &Industrial Engineering, University of Illinois at Chicago, Chicago, Illinois, United States*
[2]*Instituto de Química, Universidade de São Paulo, São Paulo-SP, Brazil*
[3]*Department of Civil & Materials Engineering, University of Illinois at Chicago, Chicago, IL, USA*
[4]*Department of Biomedical Engineering, University of Illinois at Chicago, Chicago, IL, USA*
[5]*Centro de Engenharia, Modelagem e Ciências Sociais Aplicadas, Universidade Federal do ABC, Santo André, SP, Brazil*

Palavras Chave: *High-Entropy Coordination Compound, High-Entropy Metal-Glycerolate, High-Entropy Oxides, Spinel Phase.*

Highlights

High-entropy metal glycerolate was synthesized via one-step solvothermal method. The High-entropy metal-glycerolate were used as a precursor in design of porous high-entropy oxide microparticles.

Resumo/Abstract

High-entropy materials have received notable attention concern on account of their unique structure, tunable properties, and unprecedented potential applications in many fields. In this work, for the first time a NiCoMnZnMg-containing high-entropy glycerolate (HE-Gly) particles has been synthesized using a scalable solvothermal method. The HE-Gly particles were used as a precursor in design of porous high-entropy oxide (HEO) microparticles. The morphological and structural characterizations demonstrate that the temperature of the annealing process, and the composition of the metal ions in the HE-Gly precursors play important roles in determining porosity, crystallinity, and phase separation in HEOs. In fact, HE-Gly exhibited a porous structure of spinel HEOs with secreted MgO phase after annealing process at 800 °C (HEO800), while the annealing process at 400 °C (HEO400) led to a low-crystallinity spinel phase without phase segregation (Figure 1). Overall, this work describes a new precursor HE-Gly for a HEOs designer, whose composition, crystallinity, and porosity can be easily controlled. This strategy can lead to future industrial applications, paving a new path toward synthesizing high-entropy materials.

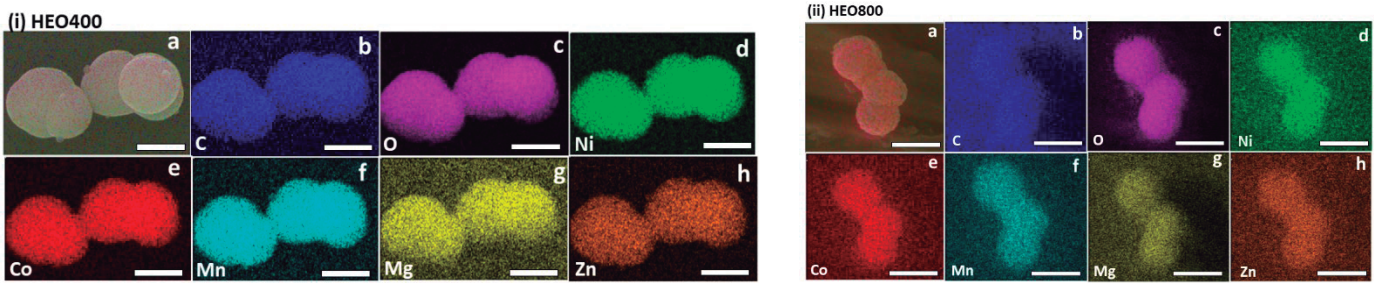

Figure 1. SEM-EDS analysis of (i) HEO400 (scale bar corresponds to 1 μm), and (ii) HEO800 particles (scale bar corresponds to 1 μm). (a) EDS overlap mapping of HEO particles. EDS elemental mapping of individual elements constituting HEO particles indicating the high mixing entropy. (b) carbon (blue), (c) oxygen (magenta), (d) nickel (green), (e) cobalt (red), (f) manganese (light blue), (g) magnesium (yellow), and (h) zinc (orange).

Agradecimentos/Acknowledgments

National Science Foundation DMR-1809439, FAPESP (2018/16896–7 and 2020/06176-7) and CNPq (311847–2018–8, 465389/2014–7, 202290/2020-4). Soft and Hybrid Nanotechnology Experimental (SHyNE) Resource (NSF ECCS-1542205), the MRSEC program (NSF DMR-1720139) at the Materials Research Center.