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Construction of Macroscopic 3D Foams of Metastable Manganese Oxides via a Mild Templating Route: Effects of Atmosphere and Calcination

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Abstract: Manganese oxides are metastable phases due to oxygen loss at high temperature. Conventional ceramic routes need high temperature and thus are unsuitable for making MnO_x foams. A mild templating route at 300-400°C was developed to construct metastable MnO_x foams. Interwoven OMS-2 (cryptomelane) nanofibers with a length-diameter ratio of ca. 3000 over a template may create an OMS-2 foam at 400°C with an atmosphere of 21% O_2 content, a MnO/C foam at 400°C with an atmosphere of 0% O_2 content, OMS-2/ Mn_3O_4 foams at 400°C with an atmosphere of 1-5% O_2 content, or $\text{Mn}_3\text{O}_4/\text{MnO}_2$ foams at 300-350°C in an atmosphere of 1% O_2 content. Three foam materials are materials with ductility while others belong to brittle materials.

Keywords: manganese oxide, foam, metastable, morphology

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