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J. J. Gao [1,*], H.-J. Qiu [1,*], Y. R. Wen [2,*], F.-K. Chiang [3], Y. Wang [1,*]

[1] The State Key Laboratory of Mechanical Transmissions and School of Chemistry and Chemical Engineering, Chongqing University, Chongqing 400044, China

[2] Institute of Physics, Chinese Academy of Sciences, Beijing 100190, P. R. China

[3] National Institute of Clean-and-Low-Carbon Energy, Beijing 102209, P. R. China

Email: hjqiu@cqu.edu.cn (H.J.Qiu)

wyrscu@163.com (Y.R.Wen)

wangy@cqu.edu.cn (Y. Wang).

Abstract

Free-standing nanoporous Ni-Cu-Mn mixed metal oxides on metal with a high surface area was fabricated by chemically dealloying a $\text{Ni}_8\text{Cu}_{12}\text{Mn}_{80}$ single-phase precursor, followed by electrochemical oxidation in an alkaline solution. Electrochemical analysis shows that first Cu and Mn-based metal oxides formed by the electrochemical oxidation. Ni-based oxides grow later with the increase of electrochemical CV cycles and mix with the Cu/Mn oxides, forming a relatively stable mixed metal oxides thin film on metal ligament network. Due to the different electrochemical properties of each metal and the synergetic effect between them, the mixed ternary metal oxides formed on metal nano-ligament can operate stably between a wide potential window (1.5 V) in 1.0 M KOH aqueous solution when tested as a free-standing supercapacitor electrode. Due to the high volumetric surface area, wide operating potential window and excellent conductivity, the nanoporous metal oxides@metal composite exhibits a high volumetric capacitance ($\sim 500 \text{ F cm}^{-3}$), high energy density ($\sim 38 \text{ mW h cm}^{-3}$) and good cycling stability.

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