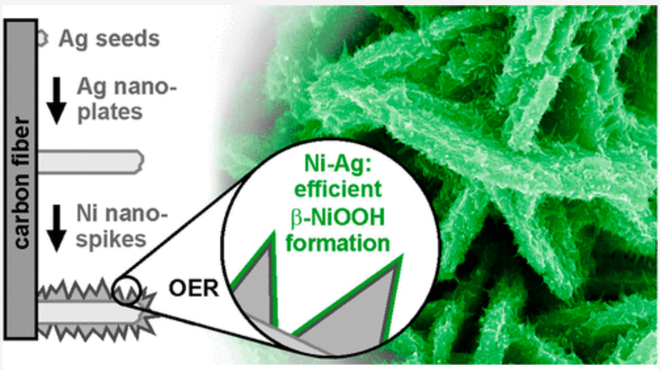
ACS APPLIED NANO MATERIALS

Shape-Controlled Electroless Plating of Hetero-Nanostructures: AgCu- and AgNi-Decorated Ag Nanoplates on Carbon Fibers as Catalysts for the Oxygen Evolution Reaction

Patrick Bräuer, Falk Muench, Sasho Stojkovikj, Siddharth Gupta, Matthew T. Mayer, Wolfgang Ensinger, Christina Roth, and Gumaa A. El-Nagar*

Cite this: *ACS Appl. Nano Mater.* 2022, 5, 8, 10348–10357
Publication Date: July 19, 2022
https://doi.org/10.1021/acsanm.2c01618

Abstract



This study addresses the potential of combining multiple electroless plating reactions for homogeneous decoration of three-dimensional carbon fibers (CFs) with shape-controlled AgNi and AgCu bimetallic nanostructures. Morphology, crystal structure, and composition of the obtained bimetallic nanostructures were systemically examined by various spectroscopic and microscopic techniques including scanning electron microscopy, transmission electron microscopy, X-ray diffraction, and X-ray photoelectron spectroscopy. The electrocatalytic performance of the synthesized materials was investigated for the oxygen evolution reaction (OER). AgCu and AgNi bimetallic surfaces showed superior activity and stability compared to pristine Ag, Ni, or Cu. These observed enhancements on the bimetallic nanostructures are attributed to the synergistic effect between the elements present. AgNi nanoplate-decorated CFs exhibited the highest activity toward OER, which is attributed to the key role of Ag in stabilizing and increasing the number of β-NiOOH surface sites, which are the most relevant OER-active Ni species.

KEYWORDS: electroless plating, oxygen evolution reaction, silver nanoplates, bimetallic nanostructures, water electrolysis