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Core-Shell Copper and Nickel Nanofoam: Uniform Electroplating and Properties

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ABSTRACT

Characterizing materials on the nanoscale is a key factor to enhance nanotechnology in diverse applications, ranging from electronics to energy fields. However, controlling the structure of the material at the nanoscale or mimicking the nanoscale features of a structure that already exists requires linking processing conditions to the nanostructure. This work focuses on solids that show porous patterns at the nano-micro scale; these are often called cellular solids and classified into two categories: honeycombs and foams. This study focuses on nanofoams; with ligament dimensions in the sub-micron scale. Electrospinning has been developed to produce nanofoam structures of polymers with controlled ligament sizes. In this current research, a copper nanofoam was produced by electrospinning a polymer which contained a Cu component. This was followed by heat treatments that formed an oxide, and then subsequently reduced to form the pure metal foam. The obtained copper nanofoam was then electroplated with nickel by putting it in a nickel bath and applying current. It was found, after taking images using scanning electron microscopy, that the electroplated nickel takes a uniform shape along with the existing foam of copper, it was observed also that the nickel is depositing over the ligaments of the copper nanofoam structure. Obtaining core-shell metallic nanofoams such as copper and nickel appears to be possible through electrospinning, thermal treatments, and subsequent electroplating, but controlling the thickness of the shell of nickel over the copper ligaments of the nanofoam requires further experimentation and can be done on different types of metals.

KEYWORDS

Nanofoam, Electroplating, Electrospinning