A novel approach to fabricate Cu-Ni core-shell microwires

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Abstract: Metallic microwires are a promising material for use as a filler in various conductive composite structures. Because of their high anisotropy in shape, a low percolation threshold could be achieved, which is beneficial to a low-cost fabrication and better electrical conductivity even under an extremely low solid content. Here we developed a facile method to fabricate the Cu (core)-Ni (shell) microwires.

1. Introduction

Core-shell metallic microwires have received much attention because of the way in which their chemical, catalytic, and electro-magnetic properties differ from those of individual materials [1-5]. These core-shell microwires are typically synthesized through chemical reduction, but this method requires the long processing time, an expensive electrochemical workstation and fails to provide adequate shape control [6-8]. Thus, unfortunately, a simple and scalable method for fabrication of the microscale and anisotropically-shaped core-shell microwires has not been reported so far.

2. Result

A simple approach for the preparation of core-shell microwires with an anisotropic shape is proposed in which an Ag nanowire/polymer composite produced by inverted layer processing is used as a temporary template for the sequential electroless plating of a Cu metal core and Ni. Diameter, length and even the thickness of the shell could be delicately controlled by an optimization of the plating conditions and AgNW density. Residual stresses induced at the interfaces between the formed microwires and AgNW-polymer composite surface made them easily detached by a brief ultrasonication (shorter than 10 sec). Finally the Cu-Ni core-shell microwires could be fabricated and dispersed in a preferred solution. This newly developed method is therefore believed to provide an effective means of overcoming the major challenges that have previously been faced in preparing core-shell microstructures with an anisotropic shape.

3. Conclusion

This technique is therefore considered to be readily applicable to the fabrication of conductive fillers for use in composite structures.

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