Synthesis and Characterization of Hydrid Transition Metal/Iron Nanowires

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Abstract

The purpose of this study was to synthesize iron nanowires with high-saturated magnetization and low coercivity. For nickel and copper were both relatively stable elements in a transition metal, Ni and Cu were be used to form a protective layer on iron nanowire via doping or coating. This work will study the formation of Ni, Cu, and Fe solid solution by comparing the structure and composition. XRD patterns and TEM mapping could confirm solid solution formation.

In VSM results, the Cu series iron nanowires have lower coercivity (192.5～316.1 OE) than Ni series. Cu:Fe NW with 1wt% Cu has the best-saturated magnetization (146.4emu/g). The second best was Ni:Fe(1:99) with 121.7emu/g.
The XAS results reveal that both Fe^{2+} and Fe^{3+} existed in iron nanowires. According to the L-edge, the iron oxide was magnetite. It also verified the observed Fe_3O_4 in XRD. The analyzed R-space shows the bond length of Fe-O 1.4-1.6 Å consistent with TEM diffraction results.

Keywords: iron nanowires, nickel, copper, anti-oxidation, electromagnetic interference