The Controllable Fabrication of Nickel Nanowires by Chemical Reduction Route

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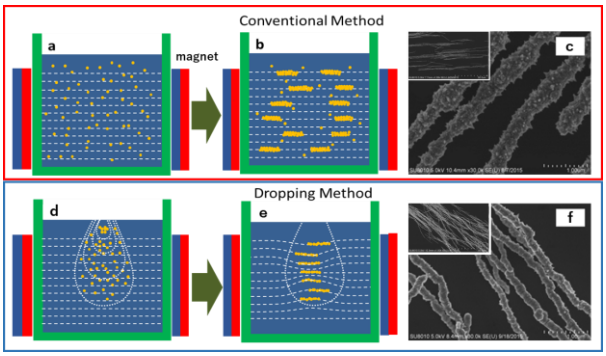
In recent years, the synthesis of nanowires by chemical reduction route attracted considerable attention since it is low-cost, environmentally friendly, safe and feasible process. However, the Ni nanowires prepared by conventional chemical reduction method usually have very low aspect ratio (<100) and large diameter (usually much larger than 100 nm), indicating it is very difficult to control the size of Ni nanowires by this method.

Herein, we proposed a facile and high-yield route, dropping method, to synthesize Ni nanowires with high aspect ratio. This method is firstly to place the reduction agent in the external magnetic field and then dropped the precursor solution which containing the Ni salts. (In the conventional way, the reducing agent is usually merged homogenously with precursor solution, then placed in the magnetic field.) We found the diameter of Ni nanowires prepared by the dropping method distinctively decreased and the surface roughness was improved than the conventional method under the same reaction condition[1].

We successfully obtained thin and long nanowires which diameter is 70nm and aspect ratio is ~600 using dropping method by optimizing the reaction parameters such as the Ni^{2+}concentration and the volume of the dropped precursor solution. We found that the average diameter of nanowires will be reduced from 350nm to 85nm by reducing the Ni^{2+} concentration and the precursor solution addition, such dependence could be explained by a simple empirical model[2]. In addition, the surface of Ni nanowires will be smoother when the Ni^{2+} concentration and the precursor solution addition is lower, and synthesized temperature is higher. To the best of our knowledge, the dropping method is a unique approach in the chemical reduction route to synthesize Ni nanowires with diameter less than 100 nm and length larger than 20 μm.

This work presents a preferred approach to fabricate one-dimensional magnetic materials with controllable size and morphology which have potential applications in electrochemical devices, magnetic sensors, and catalytic agents.



Fig,1 Schematic illustration of the synthesis of Ni nanowires and its SEM images of conventional method (a, b, c) and dropping method (d, e, f).

1 Zhang JQ, Xiang WF, et al. *Nanoscale Res. Lett*, 11 (2016): 118.

2 Xiang WF, Zhang JQ, et al. *Journal of Alloys and Compounds*, 693 (2017): 257-263.