

Spin injection into a Semimetallic Bismuth Nanowire

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Spin injection has been a basic research topic of continuing interest. The spin injection technique is extended to a new materials system, semimetals. A study of the electrical injection and detection of spin polarized electrons in Bi thin films is presented, with several important consequences. (i) First, the extension of an established technique to a novel materials system is of intrinsic importance. (ii) Second, the semimetal system permits a new evaluation of important issues related to the ferromagnetic metal/nonmagnetic material interface. (iii) Third, the spin diffusion length in an FM/Bi/FM junction was found to be remarkably long, $\delta_s \approx 100 \mu\text{m}$.

In the present work, we report on the spin injection and detection in a Bi nanowire. Bi nanowires have been prepared prepared using electroplating and porous anodic aluminum oxide (AAO) templates as seen in Fig. 1. The nanowires were separated and dispersed onto a thermally oxidized Si(100) substrate after removal of AAO by an appropriate chemical treatment. A nano-scaled devices using a Bi nanowire fabricated by using an electron beam lithography process and a DC magnetron sputtering technique. The detailed procedure for the fabrication of a Bi nanowire device is presented in Fig. 2. The mechanism of the electrical spin injection and detection in a quasi 1-dimensional wire is discussed.

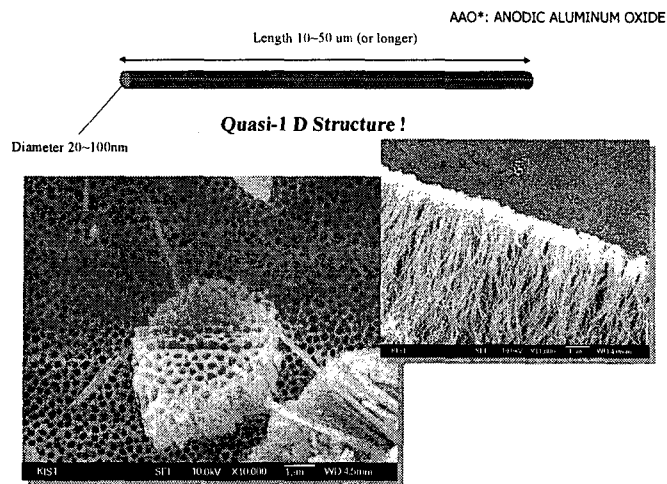


Fig. 1 SEM images of Bi nanowires prepared using electroplating and porous anodic aluminum oxide (AAO) templates.

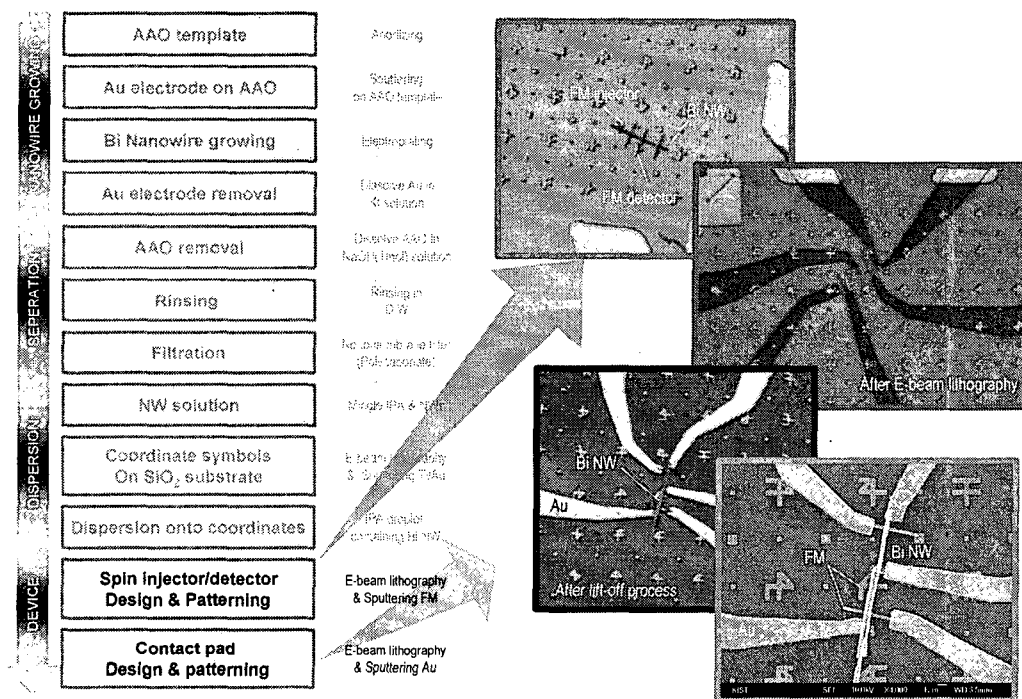


Fig. 2 Fabrication procedure for a Bi nanowire device from AAO

References

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