Ni-Si Nanowires as an Anode material for Lithium Ion Batteries

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Thin film, Si and NiSi nanowires containing anodes were deposited on copper foil by electron beam evaporation with oblique angle codeposition technique. The electrochemical performances of Ni-Si nanowires containing anode material were compared with that of pure Si nanowires containing anode material. The results revealed that thin film anode with pure Si nanowires had a higher initial anodic capacity around 2000 $mAhg^{-1}$, but the capacity diminished in first 10 cycles due to the morphological changes and the capacity became stable around 300 $mAhg^{-1}$. By introducing approximately 9 wt.% Ni into Si nanowires, an anode material containing Ni-Si composite nanowires was fabricated. This electrode demonstrated approximately 1600$mAhg^{-1}$ of initial discharge capacity. In the second cycle, its discharge capacity decreased to 1000 $mAhg^{-1}$ and fluctuated around 900 $mAhg^{-1}$ upto 80 cycles. The high capacity retention and long cycle life of Ni-Si thin film anode is attributed to the flexibility, improved conductivity and toughness of NiSi composite nanowires.

Keywords: Ni-Si thin film, oblique angle deposition, lithium ion batteries, anode.