Investigation of novel nanostructured tungsten oxides as high volumetric capacity and high safe anode materials in lithium ion batteries

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Conversion-based metal (M= Mo, W..) oxides have been investigated as the candidates of anode materials in lithium ion batteries. Among them, tungsten based oxide anodes have exhibited high specific and volumetric capacity, and high safety. However, the conversion reaction of these metals with lithium has been reported to be sluggish indicative of limited rate capability. Furthermore, low electrical conductivity of tungsten (W6+) oxide required further reduction treatment, which produces partially reduced W5+ species. In order to overcome these obstacles, nanostructurization of tungsten oxide can be employed, which has been tried in molybdenum oxides.

Herein, novel ordered mesoporous tungsten oxides and their nanocomposite with carbon have been prepared [1,2]. To this purpose, various template methods such as hard silica templating and block-copolymer templating have been tried. The prepared nanostructured materials were characterized using various physicochemical methods, which revealed that well ordered mesopores were observed and abundant W5+ species due to reducing environment by carbon. As-prepared materials were applied into anodes in lithium ion batteries. Due to the high electrical conductivity and well-ordered mesopores, this anode exhibited improved specific capacity and high rate capability. In addition, the charging mechanism study was conducted using galvanostatic intermittent titration method and in-situ X-ray diffraction.

References

[1] S. Yoon, S. Y. Noh, C. Jo, C. W. Lee, J. H. Song, J. Lee**,** , *Phys. Chem. Chem. Phys.* **13**, 11060 (2011)

[2] C. Jo, J. Hwang, H. Song, A. H. Dao, Y.-T. Kim, S. H. Lee, S. Hong, S. Yoon, J. Lee, *Adv. Func. Mater.* 10.1002/adfm.201202682