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$Li_4Ti_5O_{12}$ based material as high performance electrode for Lithium ion batteries and hybrid supercapacitor

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Spinel $Li_4Ti_5O_{12}$ (LTO) has been considered as one of the excellent materials to improve and reinforce the weak points of conventional carbon anode material. It has advantages of negligible structural change during the charge/discharge process, good Li+ diffusion channels due to 3-dimensional structure and no formation of solid electrolyte interphase (SEI). However, LTO has low conductivity. In order to overcome this drawback, doping with anions and cations, coating with metal and oxide and making composite with other materials. In doping method, most of studies have been focused on single doping material. In this study, we tried co-doping of two different elements. The combinations of materials were over 300 pairs. We found the best doping combination. To improve the cycle performance even more, we coated ZnO, Al_2O_3, Al-doped ZnO of several nm on the surface of LTO electrode using atomic layer deposition. We also introduce the application of LTO to hybrid supercapacitor. The effect of various LTOs that was fabricated on different process conditions on electrochemical performance of hybrid supercapacitor will be discussed.

Biography

Jae Hyun Kim completed his Doctorate in Materials Science and Engineering with magnetic semiconductor and device at the Korea Advanced Institute of Science and Technology in 2003. He focused on the new material synthesis by pulsed laser deposition and its application to devices and characterization of the materials by high resolution transmission microscopy. After his development and characterization of new materials, he joined LG. Philips LCD as senior research engineer, where he directed design and process development of TFT-LCD TV panel in 2003 ~ 2005. He opened new area for large TFT-LCD TV by optimizing the design of TFT and CF glass. He also contributed to reduction of fraction defective by innovative improvement of process window in liquid crystal drop. He moved to Daegu Gyeongbuk Institute of Science and Technology in 2005. He developed new device structure for organic thin film transistor of high performance. He has directed his research to fabrication of various one-dimensional Si nano/micro structures by electrochemical etching and noble metal catalytic etching. He is devoting to improving the efficiency of radial p-n junction solar cell by using one-dimensional Si wire arrays and is also developing the wire array transfer technique onto other substrate. He is doing research on anode materials including Li4Ti5O12 (LTO) based materials, Si nanowires. He is also studying the enhancement of electrochemical performance of the hybrid supercapacitor. Concurrently, he is interested in unified device of combining various renewable energy source elements.

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