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The Effect of Y Doping on Electrochemical Behavior of Spherical $Li_4Ti_5O_{12}$ for Li-ion Batteries

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$Li_4Ti_5O_{12}$ is emerging as a promising material with its good structure stability and little volume change during the electrochemical reaction. However, its electrochemical performance is significantly limited by low electronic or ionic conductivity. In addition, high tap density is needed forim proving its volumetric energy density and commercialization. To enhance these properties, the spherical-like $Li_4Ti_5O_{12}$ particles were synthesized and carried out doping with yttrium. Prepared Y-doped $Li_4Ti_5O_{12}$ as a anode material showed great capacity retention rate of 92% (5C/0.2C), compared with no dope done. Consequently, it was found that Y doping into $Li_4Ti_5O_{12}$ matrix reduces the polarization and resistance on SEI layer during the electrochemical reaction.

Keywords: $Li_4Ti_5O_{12}$, Anode material

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Mechanism for Ni/YSZ Nano-composite Anode from Spherical Core-shell Formation

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We studied a method of manufacturing an anode to restrict contraction in reducing NiO/YSZ by uniformly mixing. In order to mix Ni and YSZ, a sub-micron Ni core surface was coated at high-speed by a mixture of nano-sized YSZ and a spherical core-shell was subsequently formed. The micron-sized core-shell anode powder was then heat treated at 400～1,450°C in an air atmosphere and Ni was extruded and synthesized in nano-size. Subsequently, when the nano-sized mixture of the anode was heat treated and maintained at a temperature of 1,450°C, the anode was manufactured, where Ni and YSZ were uniformly distributed with the nano-structure. According to the nano-sized anode powder synthesis process, Ni particles were oxidized at 400～500°C and became spherical by surface tension. In the case of the spherical core Ni powder, the heat treatment temperature rose to 1,250°C and then a gap between the internal and external pressures occurred due to thermal and tensile stresses. A crack subsequently appeared on the surface, and the heat treatment temperature was increased continuously to increase the pressure gap and then the core Ni extruded as a nano-sized powder, Ni and YSZ uniformly distributed. It was found that the anode of 50～200 nm with a consistent structure obtained in this study has electric conductivity that is approximately 3 times larger than that of a commercial anode.

Keywords: SOFC, Anode, Core-shell, Nano-structure