Enhanced Electrochemical Properties by Si-doped ZnO Applied to Lithium-Sulfur Batteries

Wan-Ting Tsou, Jenq-Gong Duh

Department of Material Science and Engineering, National Tsing-Hua University

E-mail : ca302004@gmail.com

Among the secondary-use energy storage system, lithium–sulfur battery provides a theoretical specific energy of 2600 Wh kg^{-1}, which is much higher than the specific energy of lithium-ion battery. In addition, Li-S batteries possesses great advantages of low cost and environmental friendliness. Therefore, Li-S batteries are considered to be a candidate of electrochemical devices applied in electric vehicle market.

However, Li–S batteries are still hampered by short cycle life and poor rate capability due to low sulfur utilization and the shuttle effect before commercial application. Polar metal oxides, such as TiO_2, MnO_2, Al_2O_3, are commonly used to immobilize lithium sulfides. Nevertheless, the high electronic resistivity of those metal oxides may hinder the redox kinetics.

In this study, an unexpansive polar metal oxide, Si-doped ZnO is presented. By doping with certain concentration of silicon, zinc oxide exhibits higher electrical conductivity. MCMB is decorated with Si-doped ZnO to be the host of sulfur by wet impregnation method. The electrochemical potential window from 2.6V to 1.7 V, high rate, charge-discharge and long cycle test has shown improved electrochemical properties with the aid of Si-doped ZnO/MCMB. The enhanced electrochemical performance of Li-S batteries are attributed to the Si-doped ZnO/MCMB host that effectively suppresses shuttle effect.