

# **Electrochemical Characteristics of Al-Doped ZnO Films by Magnetron Sputtering**

He-Qun Dai<sup>a,b</sup>, Hao Xu<sup>a,b</sup>, Yong-Ning Zhou<sup>b</sup>, Fang Lu<sup>a</sup>, Zheng-Wen Fu<sup>b\*,z</sup>

<sup>a</sup> *Shanghai Key laboratory of Molecular Catalysts and Innovative Materials, Surface Physics Laboratory & Department of Physics, Fudan University, Shanghai 200433, China*

<sup>b</sup> *Department of Chemistry & Laser Chemistry Institute, Fudan University, Shanghai 200433, China*

## **Abstract**

Aluminum doped zinc oxide (AZO) films have been prepared by rf magnetron sputtering. The electrical properties and electrochemical behavior are investigated by Hall measurement, galvanostic cycling and cyclic voltammograms. The result demonstrates that doping with a small amount of aluminum (< 3 wt %) can improve the electrochemical performance of ZnO significantly. Among all the AZO films, AZO2 (2 wt % Al<sub>2</sub>O<sub>3</sub>) film shows the best behavior with a large reversible specific capacity around 590 mAh g<sup>-1</sup> and excellent capacity retention. HRTEM and SAED measurements confirm the formation of LiAl and nanosized Al<sub>2</sub>O<sub>3</sub> during the first discharge and charge processes, respectively. The electrochemical reaction mechanism of AZO with lithium is proposed. It is believed that the nanosized Al<sub>2</sub>O<sub>3</sub> formed after the charge process in AZO films plays an important role in the improvement of electrochemical performance.