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Towards synthesis of transition metal nitride thin films for Li-ion batteries: example of Cu₃N and RuN

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In recent years, more attention has been paid to research on high performance anode materials for Li-ion batteries. Bagetto and *al.* [1] have recently reported for SnN_x thin films a impressive capacitance of ~ 700 mAh/g and a good durability at 0.8 V vs. Li⁺/Li. Nevertheless the electrochemical process involved is still in debate.

In the present work, novel transition metal nitrides of Cu₃N and RuN have been successfully deposited by using DC magnetron sputtering in various Ar-N₂ reactive atmospheres. For the first time, RuN thin films were synthesized with a ZnS like structure.

The electrochemical reactions of lithium with Cu₃N and RuN thin film electrodes were first investigated by performing galvanostatic discharge and charge and cyclic voltammetry experiments. These thin film electrodes exhibited reversible discharge capacities ranging from 300 mAh/g to 400 mAh/g.

The structure, morphology, and composition of the as-deposited, lithiated, and delithiated Cu₃N and RuN thin films have been characterized by X-ray diffraction (XRD), and scanning electron microscopy (SEM).

The reaction mechanism is not clear, and experiments are still in progress.

Although as Zheng-Wen Fu and *al.* [2] have reported for Co₃N and Fe₃N electrodes, we can suppose that transition metallic Cu and Ru formed during the first discharging is nitrated and another part as an active spectator may play a major role in driving the decomposition and formation of Li₃N during the subsequent electrochemical reaction.

[1] Bagetto and *al.* J.Electrochem. Soc. 2010

[2] Zheng-Wen Fu and *al.* J. Phys. Chem. B, 2004, 108 (7), pp 2236-2244

Keywords

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