Characterization of RF-Sputtered $LiCoO_2$ Thin Films Deposited on 30 µm SUS304 Foils for Application in Flexible Thin Film Rechargeable Batteries

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Thin film lithium or lithium ion batteries have received a lot of attention due to their potential application as backup power source in smart cards, battery-assisted RFID tags, wireless sensor networks, real-time clock back-up batteries, and multiple healthcare applications, including hearing aids, automated insulin pumps and wearable health monitoring systems [1]. High quality thin film cathodes with high electrochemical performance are one of the key parts for these batteries. The cathode thin films could be prepared by different methods, including pulsed laser deposition, chemical vapor deposition, sol-gel spin coating, as well as RF magnetron sputtering [2]. However, almost all of the film electrodes need post-annealing at high temperature before they are used as cathodes in the thin film batteries. Since those preparation techniques such as RF sputtering technique normally make amorphous cathode thin film at low temperatures, a post-annealing process is then required for as-deposited film to form a crystallized structure.

It has been known that stain steel 304 (SUS304) has a series outstanding properties such as corrosion resistance, oxidation resistance, heat treatment, and formability, which applies high-temperature annealing process. In this work, we report on characterization of $LiCoO_2$ thin films deposited on 30 µm SUS304 foils by RF sputtering and annealed at various temperatures for flexible thin film lithium ion batteries. Electronic and ionic conductivities, crystalline quality and surface morphology of $LiCoO_2$ films were studied by impendence spectroscopy, X-ray diffraction and SEM, respectively. Furthermore, flexible thin film lithium ion batteries are fabricated and characterized at the applied current of 100 µA and in the voltage window of 3.0~0.5 V.

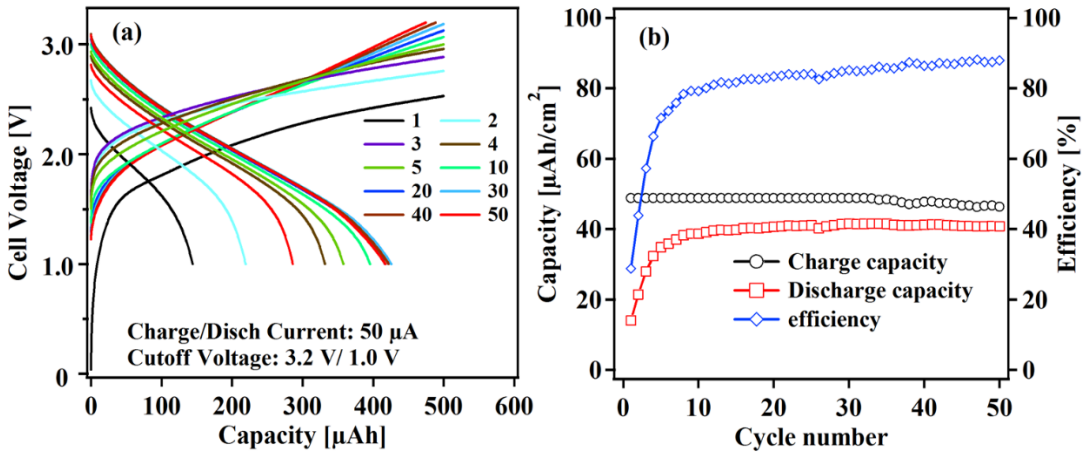

Fig. 1 (a)) Charge-discharge curves and (b) Cycling curves of a flexible thin film battery based on $LiCoO_2$ thin films (1.4 µm) annealed at 500 °C and amorphous Nb_2O_5 thin films (3.2 cm x 3.2 cm).

References:

[1] S. Priya and D. J. Inman: Energy Harvesting Technologies (Springer, 2009)
[2] K. Ozawa: Lithium Ion Rechargeable Batteries-Materials, Technologies, and New Applications (Wiley-Vch, 2009)