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Encapsulation of Rechargeable Solid-State Lithium Batteries

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Rechargeable solid-state lithium batteries were developed with lithium-cobalt oxide ($LiCoO_2$) as cathode, lithium-phosphorus oxynitride (LiPON) as electrolyte and metallic lithium (Li) as anode (Figure 1). The $LiCoO_2$ and LIPON were deposited by RF sputtering and the metallic Li by thermal evaporation. The chosen material for current collectors was titanium (deposited by e-beam technique) to prevent chemical reactions in contact with lithium, prevent delithiation and provide good electrical conductivity.

Lithium is a very reactive element, and oxidation is almost instantaneous in contact with atmosphere. For prevent the degradation of lithium, normally a glove box was connected with deposition chambers and samples manipulated without atmosphere contact. In this work, several materials were deposited and tested on lithium to prevent his degradation and provide passage of samples between chambers without necessity of connect all chambers involved on battery fabrication. Titanium and LiPO films are deposited by e-beam and RF sputtering, respectively on lithium and resistivity measured after atmosphere contact, showing good results and potential to be used as short-term protective materials in lithium batteries (see Figure 2).

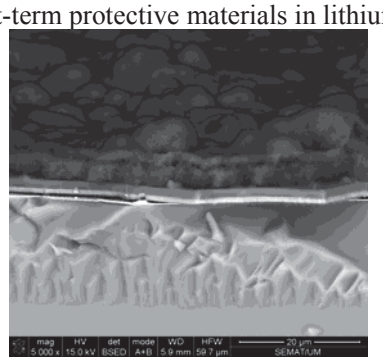

Fig. 1: Cross-sectional SEM image of the thin-film battery.

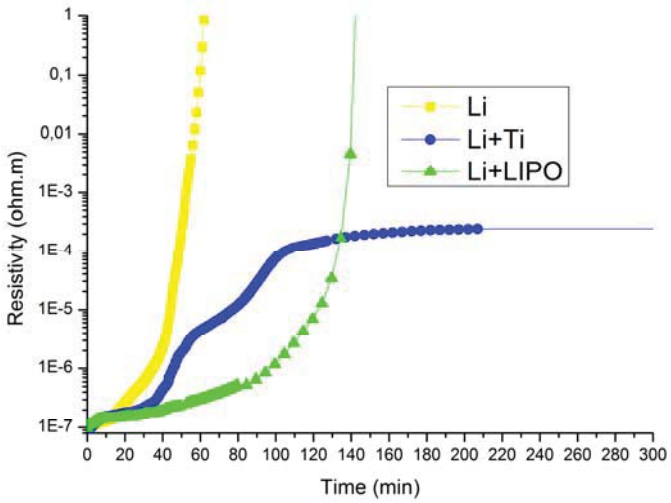

Fig. 2: Resistivity of lithium measured after atmosphere contact and comparing different protective materials.

ACKNOWLEDGMENTS

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