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Exploring the electrochemical mechanisms of InSb as negative electrode for Mg-ion batteries

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The continued acceleration of the lithium demand combined with its relatively low abundance and uneven concentration on the Earth's crust might dramatically increase its price in a near future. Magnesium batteries are promising candidates to replace Li-ion batteries thanks to Mg abundance, theoretical capacity (2.2Ah/g - 3.8Ah/cm³), low cost and safety [1]. However, metallic Mg reacts with standard electrolytes to form a blocking layer on its surface, preventing cation exchange, and thus dramatically limiting reversible stripping/deposition. An interesting alternative is to substitute Mg metal electrode with another negative electrode material compatible with conventional electrolytes. *P*-block elements (Sn, Sb, In, Pb, Bi) are a valuable solution as they electrochemically alloy with Mg and possess adequate stability in standard electrolytes [2].

In a recent work, we investigated the electrochemical reactivity and performance of the InSb alloy as a negative electrode for Mg-ion batteries [3]. A strong synergy between In and Sb has been evidenced with the promotion of the electrochemical activity of Sb towards magnesianation along few cycles, in contrast to what was already reported in other studies. While crystalline MgIn has always been detected in the case of pure In or InBi electrodes [4], we observed a kinetically dependent electrochemically-driven amorphization of MgIn which seems unique to the InSb. This behavior suggests a possible competition between crystallization and amorphization in the material. The characterization of this peculiar electrochemical behavior of InSb will be described in details. To this aim, we will present preliminary results on *operando* X-Ray Diffraction and X-Ray Absorption Spectroscopy to follow phase changes and the atomic environment of In and Sb during of the first magnesianation/demagnesianation of InSb.

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4. Murgia *et al., Electrochem. Acta.* **209**, 730-736 (2016)