

ELECTROCHEMICAL LITHIATION OF Mg FOR MODIFICATION OF SURFACE MORPHOLOGY

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Mg-based composites are promising and attractive material for energy industry. These compounds demonstrate the reversible hydrogen sorption ability and electrochemical properties. In this work we modified the Mg-electrode by Li during electrochemical lithiation for further investigation of electrochemical hydrogenation of $\text{Li}_{x+1}\text{Mg}_{1-x}$ phase.

Electrochemical insertion of Li into the structure of the polished bulk Mg-metal was carried out in the Swagelok-type cell using a powder of LiCoO_2 oxide as a positive electrode. The commercial electrolyte consisted of 1 M LiPF_6 solution in the mixture of aprotic solvents (1:1 ethylene carbonate / dimethyl carbonate). All electrochemical measurements were carried out in galvanostatic mode at 0.5 mA/cm^2 .

During the Li intercalation into the Mg structure the cell parameters of the phase increase not more 2% because of formation of the $\text{Li}_{x+1}\text{Mg}_{1-x}$ phase. After 5-th cycle we observed independent islands of the small plate-like aggregates ($2\text{--}8 \mu\text{m}$) of pore active material, after 10-th cycle all surface of the sample became etched with sponge-like morphology. Small spherical particles with size $0.1\text{--}0.5 \mu\text{m}$ form large irregular blocks. After 25-cycles we observed more significant aggregation of small particles and passivation by adsorption of components from electrolyte (Fig). Energy-dispersive X-ray spectroscopy confirms the increasing of content elements C, O, F from electrolyte after 25 cycles of lithiation. The most suitable morphology for further electrochemical measurements is after 10-th cycle, because of formation homogeneous porous mass with small particles. The thickness of the modified surface reaches $3\text{--}7 \mu\text{m}$.

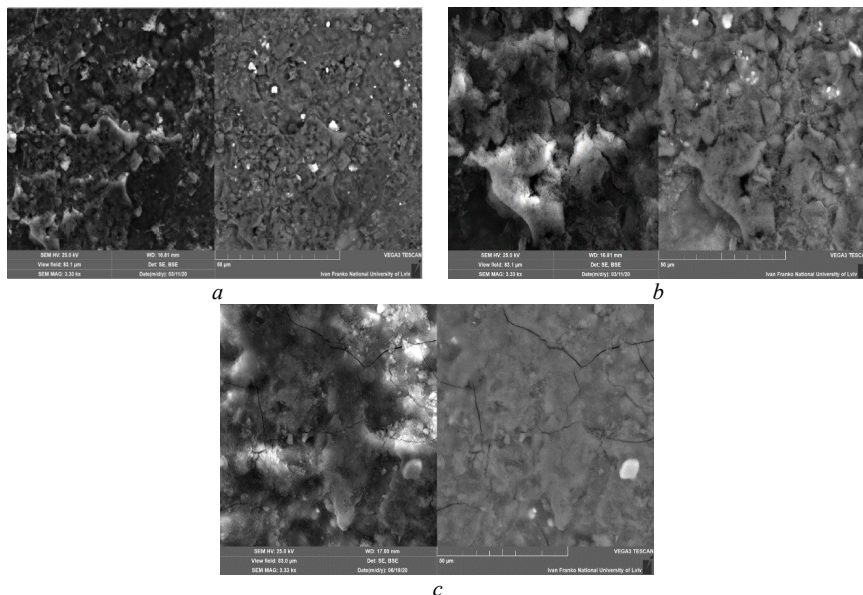


Fig. SEM-images at 3330x magnification (SE-, BSE-mode) of the $\text{Li}_{x+1}\text{Mg}_{1-x}$ after 5 cycles of lithiation (a), after 10 cycles of lithiation (b) and after 25 cycles of lithiation (c)