MnO_2 cathode enhancement by implementing Mo doping

Ņikita Griščenko[1,*], Ramona Dūrena[1], Mairis Iesalnieks[1], Anzelms Zukuls[1].
[1]*Institute of Materials and Surface Engineering, Faculty of Materials Science and Applied Chemistry, Riga Technical University, P. Valdena 3 and 7, Riga LV-1048, Latvia*
**nikita.griscenko@rtu.lv*

To counter a possible future lithium-ion battery (LIBs) shortage, the world needs a possible replacement, or at least a competitor, which could be Zn-MnO_2 technology. Rechargeable Zn-MnO_2 batteries still do not have as much coverage as LIBs due to cyclic and structural stability issues. To improve the setback properties of the MnO_2 cathode, its structure was altered with Mo doping [1-3]. In this study, MnO_2 was hydrothermally synthesised at 120 °C (12 and 24h) and doped with Mo. The obtained product was combined with carbon black and PVDF to create MnO_2 ink and cathodes were created by utilising the Doctor Blade method.
To analyse the morphology and phase composition of created cathodes variety of analyses, such as X-ray diffraction, scanning electron microscopy, energy-dispersive X-ray spectroscopy and X-ray photoelectron spectroscopy (XPS) were done. Cyclic voltammetry (CV) and galvanic charge-discharge (GCD) were performed to electrochemically describe the MnO_2 cathodes.
It was discovered that synthesised samples are made of a mix of MnO_2 polymorphs, containing α-MnO_2 and δ-MnO_2 phases, that are persistent even after CV measurements. Mo doping was successfully performed as it was detected before and after electrochemical measurements on the cathode surface. It was concluded that Mo introduction to the structure of MnO_2 promoting its stability, by sustaining Mn^{3+} oxidation state, as seen in Figure 1a. The specific capacity of MnO_2 cathodes was improved by Mo doping as seen in Figure 1b and the largest capacity values were obtained from 2.5 mol% doping levels.

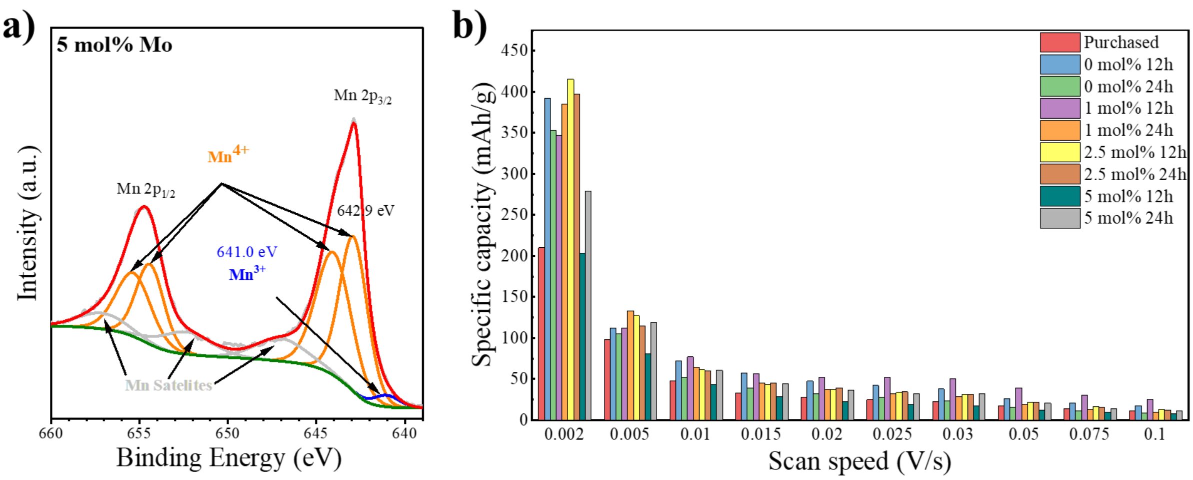

Figure 1: a) XPS results of 5 mol% Mo-MnO_2 sample and b) Specific capacity of purchased, synthesised and Mo-doped MnO_2 samples.

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