Since hydrogen is a clean and reproducible energy carrier with high energy density (up to three times larger than liquid hydrocarbon–based fuels), it is considered as one of the most promising alternatives to replace or reduce dependence on fossil fuels. However some scientific and technological barriers should be still overcome in order to use environmentally friendly hydrogen energy for transportation and stationary applications. Even though electrochemical water splitting, is a well proven technology, a large scale implementation of water electrolyzers for the generation of H_2 is still hampered by low abundance of active and stable electrocatalysts. Therefore, one of the main problems to be solved nowadays is development of new and non-expensive (non-based on noble metals) electrocatalysts for a high efficient hydrogen generation by water electrolysis. A balanced scientific attempt to energy problems requires development not only new materials for efficient energy generation but also energy storage technologies and devices. Especially, supercapacitors possess a high potential for applications as electrochemical energy sources with a high power delivery and uptake, fast charge-discharge characteristics, and with an exceptional long cycle life. Moreover, these environmentally friendly and safety devices can be operated in a wide range of temperatures.

Taking above into consideration, nanostructures of transition metal phosphides and selenides seem to be extremely interesting materials as they are promising candidates for both aforementioned energy related applications. The most innovative part of the project will be the use of electrodes in the form of well-ordered nanowire arrays instead of randomly distributed nanomaterials. Nanostructured electrodes composed of regular arrays of transition metal-based nanowires (phosphides and selenides) will be synthesized by a template-assisted electrodeposition combined with a hydrothermal method. At the beginning, transition metal (Ni, Co, Mn and Mo)-based nanowires will be electrodeposited in porous anodic aluminum oxide AAO templates. Figure 1 demonstrates a schematic diagram for the fabrication process.

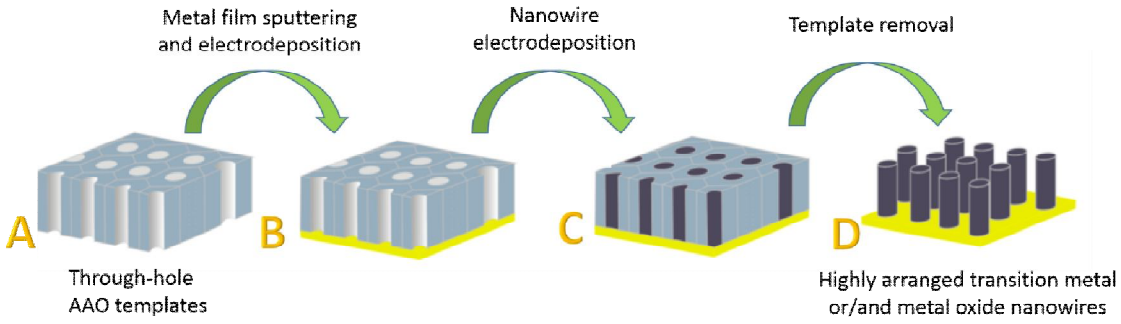

Figure 1. *Schematic diagram for the fabrication of highly arranged metal (Co, Ni) or/and metal oxide (Mn, Mo) nanowires in AAO templates.*

Then, phosphorization and selenization of obtained nanowires will be performed using P and Se powders as precursors for the vapor generation in a tube furnace. As a result, arrays of oriented metal phosphide and selenide nanowires will be created and will be further investigated in regards to water splitting catalysts and supercapacitors.