Abstract

This doctoral thesis presents the application of silicon dioxide particles for the finishing of textiles and batteries. The study is focused on the growth of silicon dioxide on the surface of cotton fibers. Using hydrophobic and oleophobic organically modified silane, the modified surface exhibited micro and nanoroughness as well as water and oil repellent properties Based on this new approach, we succeeded to prepare washing resistant, air-permeable, super hydro and oleo phobic cotton textiles. By comparing the growth of particles in the cotton fibers with the growth in selected other substrates, we confirmed the assumption that the in-situ growth of silicon dioxide is determined by the nature of the given substrate. A smaller part of the work includes the preparation of conductive textile materials in order to identify conductivity trends in the case of non-modified and modified carbon nanotubes. This part of work already belongs to the field of so-called "smart textiles".

The last section of Ph. D. research is focused on the production of silicon nanoparticles from previously prepared materials with different geometries based on silicon dioxide particles. Silicon-based anode batteries are among the materials with the highest capacity and are of interest for potential use in lithium-ion batteries. The synthesis procedure allows preparation of different shapes of nanoparticles of silicon, among which silicon nanotubes might be the most interesting.The new materials were characterized using scanning electron microscopy, high resolution transmission electron microscopy, infrared and Raman spectroscopy, NMR spectroscopy, atomic force microscopy and X-ray diffraction.

Keywords: silicon dioxide, silicon, cotton, superhydrophobic, wash-resistant, conductance, multi-wall carbon nanotubes, lithium-ion battery.