

Annotations of Doctoral Thesis Topics for Degree Course in “Nanotechnology and Advanced Materials” for the Academic Years since 2019/2020

Topic: Polymer composite materials for wearable electronics

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Annotation:

At present, increased research and ultimately application interest can be observed in the area generally called wearable electronics or wearables, etc. This is due to the parallel significant development of knowledge and skills in multi-disciplinary areas such as electrical engineering, programming and software, portable systems, as well as in the field of material science. Between such new and progressive materials polymeric nanocomposite materials should be mentioned. They possess additional acquired properties compared to conventional composites. One of the most developing areas is in materials with the ability to detect and quantify a strain or mechanical stress stimuli. Polymer composites for technology of sensors have unique properties such as high sensitivity and reversibility of responses, they can be deformed at large extends, they are flexible with low weight and can be easily and inexpensively produced. In addition, in many cases they can be prepared as multifunctional and may have other utility properties. Such as thermoelectric features, may be used as a passive antenna or for resistance heating. Last but not least, they can serve by used for process monitoring during the sensor's own fabrication process. These sensors are then used to integrate into functional units to monitor volunteer activities in the field of wearable electronics. Here, the Smart Shoe project, on which the student will make a significant contribution to his / her studies, can be mentioned. The main goal will be, above all, the next project titled Smart T-shirt, which is to analyze complex parameters such as breathing, ECG and body temperature.

Requirements:

Finished university studies in a degree of MSc. or Ing. of technical type, basic ability to communicate in English language.

Literature:

1. O'Donoghue. Data Management within mHealth Environments: Patient Sensors, Mobile Devices, and Databases. *Journal of Data and Information Quality*. 4(1), Article No. 5, 2012.
2. Banaee H. et. all. Data Mining for Wearable Sensors in Health Monitoring Systems: A Review of Recent Trends and Challenges. *Sensors* 2013, 13(12), 17472-17500.
3. Kang D. et all. Ultrasensitive mechanical crack-based sensor inspired by the spider sensory system. *Nature* 516(7530), 222-226, 2014.
4. Slobodian P., Riha P., Lengalova A., Svoboda P., Saha P., A highly-deformable composite composed of an entangled network of electrically-conductive carbon-nanotubes embedded in elastic polyurethane, *Carbon* 50(10), (2012), 3446-3453.
5. Slobodian P., Riha P., Olejník R., Cvelbar U., Saha P., Enhancing effect of KMnO₄ oxidation of carbon nanotubes network embedded in elastic polyurethane on overall electro-mechanical properties of composite, *Compos Sci Technol* 81 (2013) 54-60.