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Surface topography driven cell behavior for tissue engineering

Juseok Lee
INM-Leibniz Institute for New Materials, Germany

Response of cells to the surface topography and the concept of contact guidance have been studied for decades. Various topographical features such as grooves, ridges, pores, wells and nodes in micro- or/and nanoscale have been presented to a wide variety of cells: fibroblasts, neuronal cells, macrophages, epithelial cells, endothelial cells, and smooth muscle cells. In this context, patterning of surfaces acts as an effective tool to control the cell adhesion, migration, orientation, shape, and even gene expression. In our approach, laser interference lithography was introduced to prepare micro hierarchical periodic patterns which are composed of chaotic nanowires to study cell-surface interaction of various cells. Firstly Al/Al_2O_3 core-shell nanowires were deposited on glass substrates by decomposing the single source precursor $[^tBuOAlH_2]_2$ at elevated temperatures. Afterwards deposited layers were treated by a high energy pulsed Nd:YAG laser using two-beam interference technique. Neurons isolated from rat dorsal root ganglion, human umbilical vein smooth muscle cells, human umbilical vein endothelial cells and human stem cells were seeded and their responses on as-deposited and laser patterned Al/Al_2O_3 nanowires surfaces have been investigated. Our approach can contribute to the development of new biomedical applications such as bone and dental implants, neurochips, and cardiovascular stents.

Biography

Juseok Lee received his BS in Materials Science and Engineering from Korea University of Technology and Education. He was awarded the Erasmus-Mundus scholarship for the interdisciplinary MS at both Lulea University of Technology (Sweden) and Saarland University (Germany) where he completed his PhD Since 2009, he works in INM–Leibniz Institute for New Materials (Germany) as a research scientist. His research focuses on nanoscale materials including nanowires and functional thin films as published in Chemical Society Reviews and Small. Currently he is head of Materials Science and Technology group of Korean Scientist and Engineer Association in Germany.

JuSeok.Lee@inm-gmbh.de

Rapid and high capacity adsorption of Pb (II) by Fe_3O_4/montmorillonite nanocomposite using response surface methodology

Katayoon Kalantari
Universiti Putra Malaysia, Malaysia

Fe_3O_4/montmorillonite nanocomposite (Fe_3O_4/MMT/NCs) was synthesized for removal of lead, ion from aqueous systems. The nanoadsorbent was characterized by X-ray diffraction (XRD) and transmission electron microscopy (TEM) and mean diameter of magnetic nanoparticles was obtained about 8.24 nm. The experiments were designed by response surface methodology and quadratic model was used to prediction of the variables. The adsorption parameters of adsorbent dosage, removal time, and initial heavy metal ions concentration were used as the independent variables and their effects were investigated on the heavy metal ions removal. Variance analysis was utilized to judge the adequacy of the chosen models. Optimal conditions with initial heavy metal ion concentration of 510.16 mg/L, 120 s of removal time and 0.06 g of adsorbent amount were given 89.72% of removal efficiency for lead, copper and nickel ions, respectively. Prediction of models was in good agreement with experimental results and Fe_3O_4/MMT/NCs were found successful in removing Pb ions from aqueous solutions.

ka_upm@yahoo.com