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Observation of cell growth on the surface-modified TiO_2 nanostructures

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Abstract

In order to gain insight into how cells respond the external nanoscale environment, we used unmodified and modified surfaces of anodized TiO2 nanostructures (ATNs) to investigate the effect of those modified groups on cell morphological change and cell growth. X-ray diffraction showed the nanotubes consisted of TiO2. Those ATN were around 60.374 nm in diameter in the analyses of scanning electron microscopy (SEM). The ATNs were then modified by two varied small chemicals of 3-aminoproplytrime thexysilane (APTMS) and 3-mercaptopropyl trimethoxysilane (MPTMS). Electron spectroscopy for chemical analysis (ESCA) was used to characterize the chemical components of original Ti web, unmodified, APTMS and MPTMS modified ATNs. ESCA showed the successful surface modifications with the specific amine (-NH2 was at 399.8 eV) and mercaptal (-SH was at 162.5 eV) functional groups on the surface of APTMS and MPTMS modified ATN, respectively. In order to investigate the effect of ATN on cell growth, 3T3 fibroblasts were independently cultured on the original Ti web, unmodified and modified ATNs. SEM and fluorescent images displayed the cells thrived on unmodified and modified ATNs. In addition, quantitative analyses of cell numbers exhibited APTMS modified ATN effectively facilitated the cell proliferation with an increasingly cellular growth. We found APTMS modified ATN improved the overall capability of cell growth up to 35.6 % in our *in-vitro* observation owing to better and fully cell-membrane contact to positive charge of protonated amino groups (-NH3+). Our study showed that cells can respond sub-nano chemical environments and further altered their growth on the substrates.

Biography

Shu-Ping Lin obtained her Ph.D. in Biomedical Engineering from National Cheng Kung University in 2008. She was a visiting research associate in Dr. Themis Kyriakides's laboratory at Yale University from 2006 to 2007. She worked as a postdoctoral researcher at the Institute of Atomic and Molecular Sciences, Academia Sinica (2008-2009), and research associate at Industrial Technology Research Institute (2009-2010). In 2010, she joined Graduate Institute of Biomedical Engineering, National Chung Hsing University, as an assistant professor. She has published papers in reputed journals, such as NanoToday, Biomaterials, Biomacromolecules, Biomedical Microdevices, and Sensors, etc. Her research interests are mainly directed toward designing and developing biocompatible nano/micro biosensors, cell/tissue engineering, electrophysiological measurements, biocompatible and functionable surface modification.