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Biocompatibility and human osteoblast response to template-assisted electrohydrodynamic atomized interlocked ceramic patterns on curved 3D metallic substrates for medical implants

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The bioengineering pursuit of coating the surface of orthopedic implants such as hip replacements with bioactive materials, enhances direct biological fixation and extends functional service life. This minimizes recovery times and revision surgeries for patients. Template-assisted electrohydrodynamic atomization (TAEA) is a novel ambient temperature patterning process that has the capability to deposit a wide range of materials including bioceramics, biopolymers, composites and biological agents during manufacturing. Pattern topography can be controlled via template choice with observed marked biological benefit above continuous coatings. This work further develops TAEA to optimize the application of interlocked titania (TiO_2) and hydroxyapatite (HA) coatings onto a range of curved titanium substrates, testing and verifying bioactivity *in vitro*. Nanoindentation results indicate good adhesion between the pattern and substrate. The morphology and structure of the coatings were determined using optical and scanning electron microscopy. Parallel line microstructures with mean strut width 97±12 μm and mean spacing 54±6 μm have been successfully produced, establishing that TAEA can create patterns closely resembling the initial template across a range of process variables. MTT and AlamarBlue™ assays were carried out with human osteoblast (HOB) cell lines fixed at a range of time points (3-14 days), to elucidate non-cytotoxicity and cell proliferation *in vitro*. HOB cells responded to the parallel line pattern by elongating along and between the lines. The study therefore evidenced the potential for TAEA applications in the future design, manufacturing and functionality of the surface topography of othopadic implants by controlling and guiding cellular response.

Biography

Anouska Nithyanandan has completed her PhD in Biomaterials Engineering from University College London, under the academic supervision of Prof. Mohan Edirisinghe and Dr. Jie Huang. She has completed her Master's degree in Mechanical and Manufacturing Engineering from the University of Warwick. She is currently a Research Associate to an EPSRC-sponsored research assistantship and her work is a collaborative project between the EPSRC, UCL and JRI Orthopaedics Ltd. It is centred on developing TAEA spraying into a generic patterning process for bioactive materials and substrates for clinical use in orthopedic implant technology.

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