Growth Mechanism and Cellular Response to Film Thickness Variations of Nanoporous Alkaline Titanate-Converted, Magnetron Sputtered Ti Thin Films

Matthew D. Wadge^{1,2,*}, Kozim Midkhatov³, Jonathan Wilson², Louise Briggs², Timothy P. Cooper², Zakhar Kudrynskyi², Reda Felfel^{2,4,5}, Ifty Ahmed², Colin A. Scotchford², David M. Grant², Justyna Kulczyk-Malecka¹, Mahetab Amer³, Peter Kelly¹

¹Surface Engineering Research Group, Faculty of Science and Engineering, Manchester Metropolitan University, Manchester, UK

²Advanced Materials Research Group, Faculty of Engineering, University of Nottingham, UK

³Division of Cell Matrix and Regenerative Medicine, School of Biological Sciences, University of Manchester, Oxford Road, Manchester, UK ⁴Physics Department, Faculty of Science, Mansoura University, Mansoura, Egypt

⁵Advanced Composites Group, University of Strathclyde, Glasgow, Scotland, United Kingdom

^{*}Presenting author: m.wadge@mmu.ac.uk

Supplementary Figures:

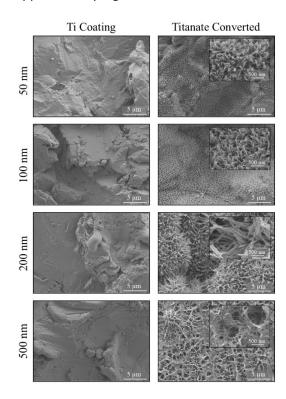


Figure 1. SEM micrographs showing the surface of unconverted and titanate converted Ti thin films of various thicknesses. A, C, E, and G) Ti coated samples with thicknesses of 50, 100, 200 and 500 nm, respectively. Insert image in A is the SS control substrate. B, D, F, and H) Titanate converted samples with initial Ti thickness of 50, 100, 200 and 500 nm, respectively.

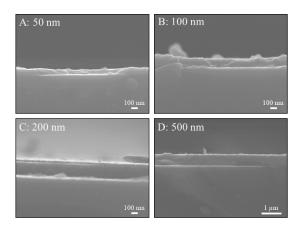


Figure 2. Representative SEM micrographs of Ti coatings prior to titanate conversion. A) 50 nm coating (50 nm_Ti), B) 100 nm coating (100 nm_Ti), C) 200 nm coating (200 nm_Ti), D) 500 nm coating (500 nm Ti).

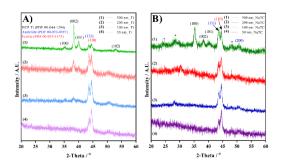


Figure 3. A) XRD spectra of unconverted samples with varying Ti thicknesses (50, 100, 200, 500 nm), with three different phases noted from the SS substrate (PDF 00-033-0397 and PDF 00-054-0331 for Austenite and Ferrite, respectively) and the Ti coating (PDF 00-044-1294). B) Titanate converted samples with varying aforementioned Ti thicknesses, with additional phases noted corresponding to titanate species (PDF 00-022-1404 and PDF 00-025-1450).

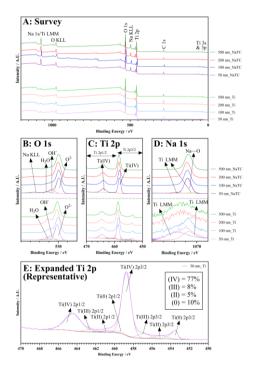


Figure 4. XPS spectra of graded Ti film thicknesses and there subsequent conversion into titanate structures. A) Survey spectra; B) O 1s high-resolution spectra; C) Ti 2p high-resolution spectra; D) Na 1s high-resolution spectra; and E) representative view of Ti 2p deconvolutions of a sputtered Ti coating showing all Ti valence states (0; II; III; IV).