Behnam Dashtbozorg, J Stem Cell Res Ther 2018, Volume 8
DOI: 10.4172/2157-7633-C2-035

Plasma nitriding and femtosecond LIPSS texturing for durable antibacterial surfaces

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Development of wear resistant, anti-biofouling and highly biocompatible surfaces presents a great challenge in the food and medical industry. Owing to their excellent corrosion resistance and low cell toxicity, austenitic stainless steels have found widespread applications in these areas. However, as a result of their poor wear resistance, surface treatments are typically necessary. One common way this is addressed is through low temperature plasma nitriding to form the S phase. In addition to improving the hardness, the S-phase also retains the corrosion resistance of the stainless steel bulk. Although this resolves many of the mechanical issues with the use of stainless steels, it does not improve their susceptibility to bacterial attachment and growth. Consequently, bactericidal elements (bacteria killing) or anti-biofouling measures (stopping attachment & growth) have to be utilised to counteract this issue. Femtosecond laser induced periodic surface structures (f-LIPSS) are known for producing self-organised bacteria resistant patterns through material ablation. However, due to the link between the anti-biofouling properties and the pattern integrity it becomes vital to preserve the textures for as long as possible. In this study it is hoped that by combining f-LIPSS pattern with active screen plasma nitriding it will be possible to produce durable and long lasting antibacterial surfaces.

Biography

Behnam Dashtbozorg is a third year PhD student with the Innovative Metal Processing (IMPaCT) centre for doctoral training (CDT). He is based at the metallurgy and materials groups at the University of Birmingham. His work involves the use of novel triple-glow plasma treatments on austenitic stainless steel materials in order to produce durable antibcacterial stainless steel surfaces for use in food and medical industries. Additionally, he is also looking at combining laser texturing and plasma surface engineering for the production of long lasting multi-functional surfaces.

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