Nanoengineered Surfaces for modulating cellular responses and sensing applications

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Abstract

The greatest challenge in the field of biomaterials is the understanding and the prediction of long-term biological responses in patients receiving implantable materials. Reconstructing and detailing these mechanisms may allow for more targeted approaches and highlights how immune processes are amenable to manipulation by synthetic biomaterials. The interplay between plasma polymerized thin films in combination with surface nanotopography proved to be an important factor in cell-surface interaction [1] (Figure 1). We demonstrated that the right combination of chemistry and nanotopography can be used to modulate cellular adhesion, collagen deposition, and macrophage polarization (the expression of pro-inflammatory and anti-inflammatory signals) [2-5] (Figure 2).
Furthermore, our surface engineering expertise was utilized to fabricate metal ion sensors and biosensors [6,7] (Figure 3). We anticipate that future explorations in this field of research will facilitate the rational design of biomedical implants and devices with physicochemical surface characteristics tailored at the nanoscale that will enhance utility and function and improve clinical outcomes.

References

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Figures

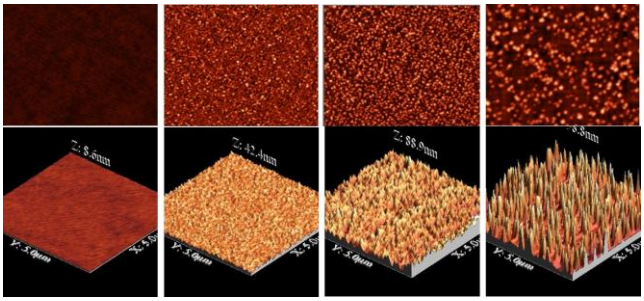

Figure 1. Atomic Force Microscopic images (2D and 3D) of surfaces modified with different sized gold nanoparticles.

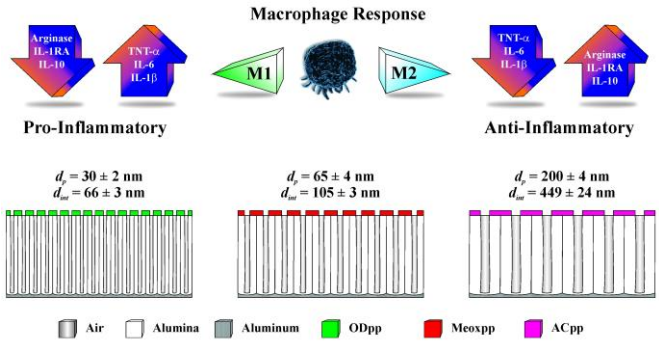

Figure 2. Schematic representation of macrophage polarization on nanoporous alumina surfaces.

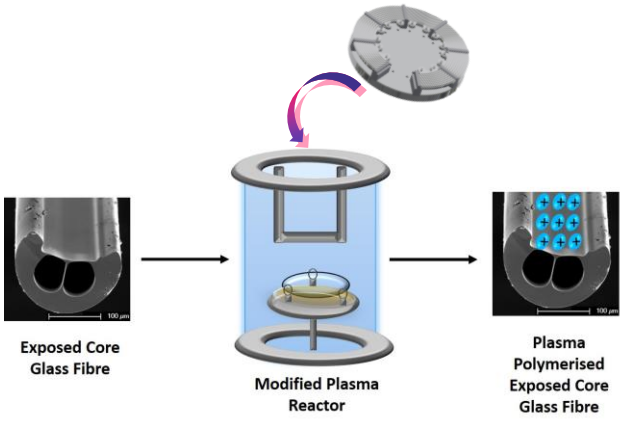

Figure 3. Schematic for plasma modification of exposed core fibre for metal ion sensing.