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Tailoring the surface of polyurethanes by plasma immersion ion implantation of nitrogen for controlling calcification

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INTRODUCTION: The flexible structure of polymers has enabled them to be useful in a wide variety of applications due to the possibility to tailor their properties to suit desired applications. Recently, there has been an increasing interest in utilizing polymers as matrices for calcium phosphate-based composites. On the other side, polyurethanes used for urea catheters, heart valves, artificial vessels present a case where calcification and biodegradation should be avoided. The modification of polymer surfaces by plasma immersion ion implantation for reducing the calcium phosphate formation is well known and has a long time effect.

METHODS: In this work, polyurethane films (PU2103 and PU2363 commercial Pellethane materials for medical applications, and newly synthesized PPG-TDI polyurethane with application as urea catheters) are modified by plasma immersion ion implantation with various doses of nitrogen ions ($5x10^{14}$ – $2x10^{16}$ $cm^{-}2$, 20 keV). Polyethylenes modified by the same ion doses are prepared as controls.

The ability of the modified polymer films to induce calcium phosphate formation from a solution resembling the human blood plasma (simulated body fluid) and the effect of the ion doses on the calcification are examined by FTIR, Raman spectroscopy, light microscopy, SEM and EDX. The analysis of the modified polyurethane films is carried out by light microscopy, XPS, FTIR and contact angle measurements.