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DEGLI STUDI
DI PADOVA



DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

AVVISO DI SEMINARIO

Venerdì 13 dicembre alle ore 12.30
presso l'Aula RH03, via Marzolo, 9 (ex-Fisica Tecnica)

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Silicon nitride: A bioceramic with a gift

Abstract: In the closing decades of the 20th century, silicon nitride (Si_3N_4) was extensively developed for high-temperature gas-turbine applications. Technologists attempted to take advantage of its superior thermal and mechanical properties to improve engine reliability and fuel economy. Yet, this promise was never realized in spite of the worldwide research, which was conducted at that time. Notwithstanding this disappointment, its use in medical applications in the early 21st century has been an unexpected gift. While retaining all of its engineered mechanical properties, it is now recognized for its peculiar surface chemistry. When immersed in an aqueous environment, the slow elution of silicon and nitrogen from its surface enhances healing of soft and osseous tissue, inhibits bacterial biofilm formation, and eradicates viruses. These benefits permit it to be used in a wide array of different disciplines inside and outside of the human body including orthopedics, dentistry, virology, agronomy, and environmental remediation. Given the global public health threat posed by mutating viruses and bacteria, silicon nitride offers a valid and straightforward alternative approach to fighting these pathogens. However, there is a conundrum behind these recent discoveries: How can this unique bioceramic be both friendly to mammalian cells while concurrently lysing invasive pathogens? This unparalleled characteristic can be explained by the pH-dependent kinetics of two ammonia species – NH_4^+ and NH_3 – both of which are leached from the wet Si_3N_4 surface.