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SLIPPERY LUBRICANT-INFUSED SILICA NANOPARTICULATE FILM PROCESSING FOR ANTI-BIOFOULING APPLICATION

Abstract

Microbial biofilm build-up in the water pipeline systems can pose a risk to human health and pipe material integrity. The impact of biofilm on hardware and health is more devastating in space stations and to astronauts due to the isolation from necessary replacement parts and medical resources. As a result, there is a need for coatings to be implemented onto the inner region of the pipe to minimize the adherence and growth of the biofilms. Lubricant-infused surfaces has been one such interesting material for anti-biofouling applications. The slippery property of lubricant-infused surfaces promotes repellency to many liquids and thus prevents bacterial adherence. Micropillars and wells are commonly used in the host substrate structure to infuse and contain the lubricant. However, there is little investigation in utilizing a nanoporous thin film as the substrate for infusion. Such a film has high porosity within the structure which can promote greater lubricant infusion and retention. In our study, we utilized a previously studied nanoporous thin film fabricated via layer-by-layer assembly of polycations and colloid silica. This coating was further functionalized with fluorosilane compounds to promote fluorinated groups upon the surface and pores of the film, which then could interact with the fluorinated lubricant. The nanoporous film was characterized to determine the morphology, thickness, surface roughness, wettability, and porosity. The lubricant-infused film was tested in its performance against bacterial adherence and growth as a result of its slippery and anti-biofouling property.