Conference Proceedings Abstract

Extended Study on the Material Compatibility of Coated Metals and Silver Biocide to Sustain Microbial Control in a Spacecraft Potable Water System

Rogelio E. Garcia Fernandez
Stacey L. Marshall
Niklas M. Adam

Providing residual microbial control to spacecraft potable water systems with ionic silver-based biocide prevails as an active research area in the Life Support System community since current and future spacecraft architectures continue to baseline biocidal silver for their potable water systems. Delivering ionic silver to potable water lines results in a more advantageous scheme from mass-requirement, hardware-constraint, antimicrobial-effectiveness, and chemical-safety perspectives than other biocidal options. Nevertheless, material compatibility of wetted components and biocidal silver must be carefully considered for preventing depletion of silver ions (especially by metal surfaces) and avoid nonbiocidal concentrations in processed water. Therefore, the selection and/or design of silver-compatible materials for wetted system components is still not clear, and fully-developed material guidelines have not been laid down. As part of a multitiered effort that looks at heritage materials, new processes and/or alternative materials, polymeric coatings are being considered as one potential solution to prevent silver-ion losses promoted by the affinity that legacy metals have towards silver ions. Previous research revealed that polymeric coatings can provide a dense barrier against silver depletion in metal-liquid interfaces for up to 16 weeks with little effect on bulk silver concentration. This publication provides new findings on the performance of eleven chemically-resistant coatings applied on Titanium Grade 2, Inconel 718, and 316L Stainless Steel coupons. The testing involved in this investigation continued to subject the coated samples to a stagnant volume of silver-containing water at a surface-area-to-volume ratio of 2.0 cm-1 for longer soaking periods and repeated exposure stages. The new results show that most of the coatings maintained silver concentration between 200 and 400 part-per-billion after 52 weeks, and the same performance persisted during sequential exposures to silver-containing water. This re-exposure process also allowed better silver ion retention with the poor-performing coatings from the first exposure stage. Additionally, the propensity of the coatings to release organic carbon into the water was preliminary investigated and discussed.