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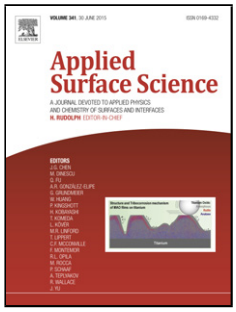

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Behavior of Ti-6Al-4V surfaces after exposure to water disinfected with ionic silver

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Highlights

- Silver is the biocide to be used in future long term missions
- Ionic silver is depleted from potable water when in contact with Ti-6Al-4V alloy
- Traces of vanadium and aluminum are found in the water bulk
- SEM and XPS analysis reveal silver deposition over Ti-6Al-4V alloy
- Silver is in its oxidized form (Ag(I) and Ag(III)) on the Ti-6Al-4V surface

Abstract

It is well documented that ionic silver prevents microbial proliferation in water systems, e.g., tanks and piping, reducing health risks and degradation of potable water quality. However, ionic silver interacts with wetted surfaces resulting in depletion of silver ions from water. This study investigates the loss of silver from water when in contact with titanium alloy Ti-6Al-4V. Use of ionic silver in Ti-6Al-4V water tanks is one of the options under consideration by National Aeronautics and Space Administration's (NASA) for disinfection of potable water in future long term missions. The present tests resemble real conditions during storage in water tanks regarding the ratio of wetted surface area to liquid volume, silver ions concentration in water as well as temperature and light conditions. In all examined cases, silver ions vanish completely from the water and at the same time traces of vanadium and aluminium mitigate from the solid surface to the water. Extensive SEM and high resolution XPS analyses demonstrate that silver is present on the Ti-6Al-4V surface in its oxidized form (Ag^{+} and Ag^{+++}). This could be explained either by the mechanism of galvanic deposition of metallic silver and its subsequent transformation to oxides or by an ion-exchange mechanism whereby silver ions are chemisorbed at negatively charged Ti-O- sites present on the surface of the Ti alloy. All present