Ion Release of Wollastonite/Forsterite Composite Coatings on the Plasma Electrolytic Oxidized Titanium Alloy

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Abstract Titanium alloys are extensively used in biomedical and aerospace applications due to their excellent mechanical properties and biocompatibility. However, their susceptibility to corrosion in certain environments remains a critical challenge. To address this, a plasma electrolytic oxidation (PEO) process was employed to form a durable and adherent oxide layer on the titanium alloy surface. This was followed by the application of a wollastonite/forsterite composite coating Wollastonite is a calcium silicate with excellent biocompatibility and has an excellent ability to induce apatite formation. However, rapid dissolution of calcium can cause excessive bone formation, so forsterite was added to reduce the dissolution rate and protect the apatite layer. Forsterite is a magnesium silicate composed of magnesium, silicon, and oxygen. It has good mechanical properties and is chemically stable, and releases silicon and magnesium ions that help bone growth and regeneration. Therefore, controlling the dissolution rate using Ca-Mg complexes can maintain the beneficial properties of apatite, such as improving bone tissue integration.

In this study, a coating was formed on a PEO-treated Ti-6Al-4V alloy by mixing wollastonite and forsterite powders through mechanical coating. After coating, surface characteristics were analyzed through corrosion tests, FE-SEM, and XPS. In conclusion, the coating of composites has the potential to enhance the corrosion properties and biocompatibility. (Supported by National Research Foundation of Korea: 2023R1A2C1005748; hcchoe@chosun.ac.kr).

Keywords: Plasma electrolytic oxidation, Ca-Mg composite, Mechanical coating,

Corrosion resistance, Ti-6Al-4V

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