

Abstract

The effects of thermal plasma treatment on the surface morphological, compositional, electrical, mechanical and wettability properties of Zirconium (Zr) have been investigated. The Zr targets were treated with atmospheric Ar thermal plasma at different Ar flow rates ranging from 10 L/min to 25 L/min and under different treatment times starting from 10 minutes to 25 minutes. SEM and optical analyses reveal the growth of different kinds of surface structures like micro rods, flakes, pores, cracks, dendrites, agglomerates, crater and ridges on treated Zr. This growth is explainable on the basis of ion induced localized heating, melting, collisional sputtering, Coulomb explosion and thermal spike model. It was observed that both the size and number density of flakes decrease from 8 μm to 5 μm and $87 \times 10^6 \text{ cm}^{-2}$ to $37 \times 10^6 \text{ cm}^{-2}$ with increasing Ar flow rate and treatment time. FTIR and XRD analyses show that there are no compositional changes in Zr after Ar plasma. Electrical conductivity, hardness and wettability are increased after treatment.