Materials Chemistry and Physics, December 2020, v256

Sintering behavior and alloying elements effects on the properties of CP-Titanium sintered using pulsed electric current

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Abstract:
Mechanical properties of grade 1 commercially pure titanium (CP–Ti) are characterized by a good combination of strength and ductility at elevated temperatures. CP-Ti mechanical properties at room and elevated temperature can be enhanced by alloying with other elements to meet up with its demand for industrial applications. In this study, the effect of Al–Mo addition and sintering temperature on the densification, microstructure, and mechanical properties of spark plasma sintered CP-Ti compacts were investigated. CP-Ti and Ti–7Al–1Mo (wt.%) compacts sintering were carried out at a constant holding time of 10 min, pressure of 50 MPa and sintering temperature of 800 °C, 1000 °C, and 1100 °C under vacuum. Full densification with Vickers hardness values of 352 ± 17 H V was obtained for the developed Ti–7Al–1Mo alloy at 1000 °C. Different microstructural transformations and phase evolution were observed in the as-sintered compact with respect to sintering temperature. The role of the alloying element and sintering temperature on the relative density, microstructure, hardness, and wear of the as-sintered samples were discussed. This paper shows that alloying of CP-Ti with Al and Mo enhances its microstructure and mechanical properties.