State-of-The-Art Titanium Alloys by Powder Metallurgy Process

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The conventional titanium (Ti) alloys are strengthened by using expensive and poisonous elements such as vanadium, niobium and molybdenum. In our previous studies, the cheap elements such as oxygen, nitrogen, carbon, silicon and hydrogen are selected to significantly improve the mechanical properties of α-Ti sintered materials by solid-solution strengthening and/or grains refinement effects. In case of iron (Fe) addition, which is one of β phase stabilizing elements, network-structured β phases containing Fe atoms were formed at α-Ti grain boundaries when the elemental mixture powder of pure Ti powder and pure Fe particles was consolidated. With increase in additional Fe contents, the volume fraction of β phase and mechanical strength proportionally increased. For example, PM Ti-6wt.%Fe alloy indicated UTS of 1246 MPa and elongation of 22.4 % at ambient temperature. These properties are much superior compared to the commercial Ti-6Al-4V (Ti64) alloys. Regarding the electrochemical corrosion behavior of Ti-Fe alloys, the corrosion current slightly decreased compared to pure Ti, however, it was not a significant difference in the industrial application. In this talk, the presentative results and performances of the novel Ti materials via powder metallurgy route will be introduced.