Synthesis and characterization of mechanically alloyed nanostructured ternary titanium based alloy for bio-medical applications

N. B. Pradeep, M. M. Rajath Hegde, Manjunath Patel GC, Khaled Giasin, Danil Yu. Pimenov, Szymon Wojciechowski

School of Mechanical & Design Engineering

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Abstract

This research article interprets the findings of experimental investigation on synthesis and characterization of a Ti alloy powder by using a high-energetic ball milling (HEBM) process. The work focuses on the synthesis of alloy powder with 70:10:20 (atomic %) of Ti, Mg, and Sr powders by process of mechanical alloying thereby decreasing the grain size of the particles to a Nanoscale regime from a micron scale. Tungsten carbide milling media was selected to synthesize alloy due to its higher density compared to elemental powder mixtures. Furthermore, the production of ternary Ti alloy with Mg and Sr additions could enhance the structural properties with density reduction which are quite suitable for biomedical applications. Mechanically alloyed powders are then characterized by X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM) with EDS, and High-Resolution Transmission electron microscopy (TEM) to investigate the structural, phase transformation, compositional, morphology, and topography. XRD results revealed that the crystallite decreased to 32.07 nm, and the formation of nonequilibrium intermetallic phases such as $MgTiO_3$, Mg_2Sr, and $Sr_3Ti_2O_7$, with an increase in ball-milling duration. However, the absence of sharp peaks i. partial amorphization of crystalline powders as the milling progresses. SEM analysis at 30 hr of milling time,