

## Effect of Milling Parameters on the Characteristics of Nanocrystalline TiAl Alloys Synthesized by Mechanical Alloying

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**Abstract :** TiAl alloy nano-powder was successfully produced by a mechanical alloying (MA) technique in a planetary ball mill. The influence of milling parameters, such as the milling duration, rotation speed, and balls-to-powder mass ratio, on the characteristics of the Ti50%Al powder, including the microstructure, crystallite size refinement, and phase formation, were investigated. It was found that MA of elemental Ti and Al powders promotes the formation of TiAl alloys, as Ti (Al) solid solution was formed after 5h of milling. Milling without the addition of process control agents led to a dramatic decrease in the crystallite size to 17.8 nm after 2h of milling. Higher rotation energy and a higher ball-to-powder weight ratio also accelerated the reduction in crystallite size. Subsequent heating up to 850°C resulted in the formation of a new intermetallic phase with a dominant TiAl<sub>3</sub> phase plus minor  $\gamma$ -TiAl or  $\alpha$ 2-Ti<sub>3</sub>Al phase or both. A longer milling duration also exhibited a better effect on the micro-hardness of Ti50%Al powders.

**Keywords :** TiAl alloys, nanocrystalline materials, mechanical alloying, materials science

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