

## Thermodynamic Analysis of Hydrogen Plasma Reduction of $\text{TiCl}_4$

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**Abstract :** With increasing demands for high performance materials, intensive interest on the Ti has been focused. Especially, low cost production process of Ti has been extremely necessitated from wide parts and various industries. Tetrachloride ( $\text{TiCl}_4$ ) is produced by fluidized bed using high  $\text{TiO}_2$  feedstock and used as an intermediate product for the production of metal titanium sponge. Reduction of  $\text{TiCl}_4$  is usually conducted by Kroll process using magnesium as a reduction reagent, producing metallic Ti in the shape of sponge. The process is batch type and takes very long time including post processes treating sponge. As an alternative reduction reagent, hydrogen in the state of plasma has long been strongly recommended. Experimental confirmation has not been completely reported yet and more strict analysis is required. In the present study, hydrogen plasma reduction process has been thermodynamically analyzed focusing the effects of temperature, pressure and concentration. All thermodynamic calculations were performed using the FactSage® thermodynamical software.

**Keywords :**  $\text{TiCl}_4$ , titanium, hydrogen, plasma, reduction, thermodynamic calculation

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