

New Titanium Production Process

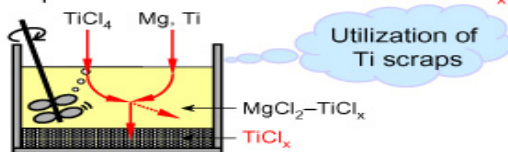
High-speed Titanium Production Process Using Titanium Subhalides Environmentally Sound Process Utilizing Titanium Scraps

High-speed Ti production process

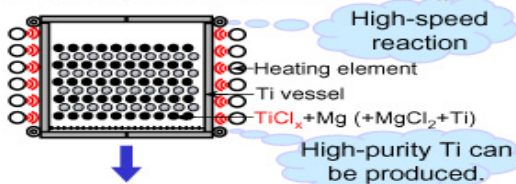
Ti production process using Ti subhalides (TiCl_x , $x = 2, 3$)

- ① $\text{TiCl}_4(l, g) + \text{Mg}(l, g) \rightarrow \text{TiCl}_x(s, l) + \text{MgCl}_2(l)$
 $\text{TiCl}_4(l, g) + \text{Ti}(s, \text{scrap}) \rightarrow \text{TiCl}_x(s, l)$
- ② $\text{TiCl}_x(s, l) + \text{Mg}(l, g) \rightarrow \text{Ti}(s) + \text{MgCl}_2(l, g)$

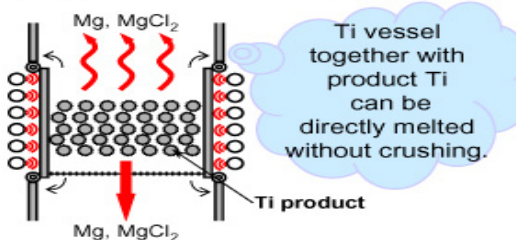
Step1: Production and enrichment of TiCl_x



Step2: High-speed reduction of TiCl_x



Step3: Removal of reaction product MgCl_2



Features and experimental result

Comparison of Kroll process and new process

	Kroll process	New process
Process type	Batch-type, limited speed	(Semi-)Continuous, high-speed
Feed material	$\text{TiCl}_4(l, g)$	$\text{TiCl}_2, \text{TiCl}_3(s, l)$
Heat of reduction	High ($\Delta H = -434 \text{ kJ molTi}$)	Low ($\Delta H = -94 - -191 \text{ kJ molTi}$)
Reactor material	Mild steel (Iron contamination unavoidable)	Titanium (No iron contamination)
Reactor size	Large (Crush and melt)	Small (No crush and direct melt)
Flux, sealant	Not used	Ti, MgCl_2
Common features	Magnesiothermic reduction of chlorides Removal of MgCl_2 and Mg from Ti sponge by vacuum distillation Production of high-purity Ti with low oxygen content	

Experiment for the magnesiothermic reduction of TiCl_3



Ti with 99.2% purity was efficiently obtained using Ti vessel.

New technologies for this process are under development.

Feasibility of new Ti production process based on the magnesiothermic reduction of Ti subhalides using Ti vessel was demonstrated.

Resource Recovery and Materials Process Engineering Laboratory

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Osamu Takeda
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Okabe Lab.

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Institute of Industrial Science, The University of Tokyo