



Global/Local Innovations for Next Generation Automobiles

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# Production of Low-Cost and Highly Functionalized Titanium by Controlling the Light Elements

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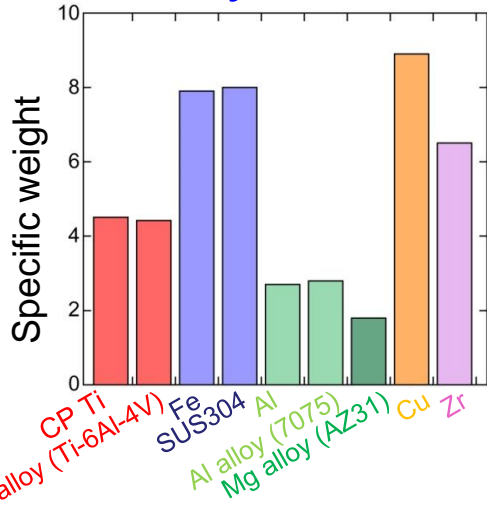
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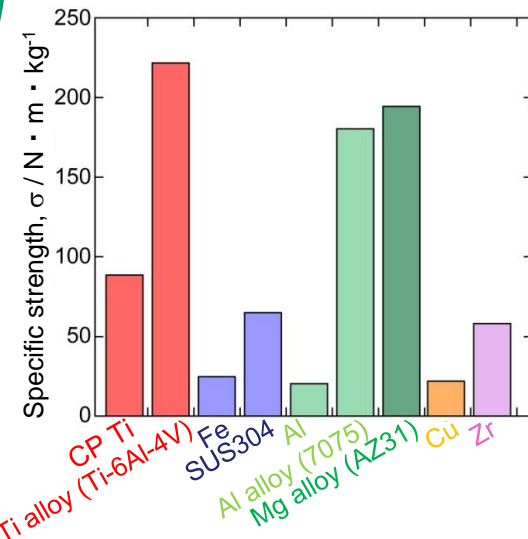
Sendai, Japan

# Titanium: *wonder metal*

Low density: 60% of Fe-based alloys



Highest specific strength in metals



**Light Weight**

**Allotropic Trans.**

**Chemically Reactive**

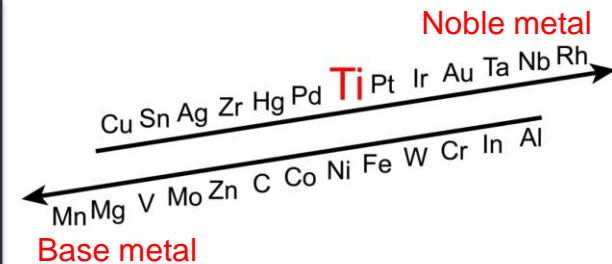
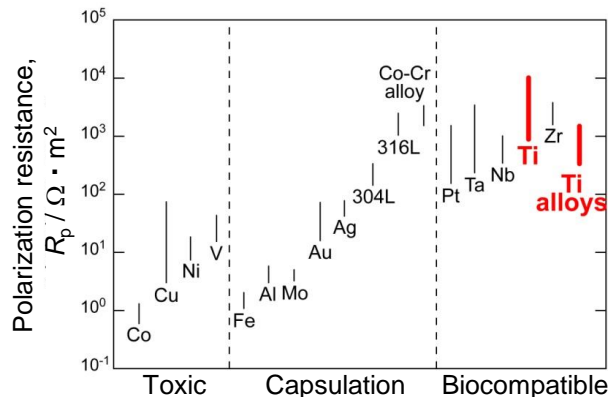
Biocompatibility

- Hypoallergenic
- Osseointegration

High corrosion resistance comparable to that of Pt



- Space aeronautics
- Medical devices
- Military
- Chemical plants



# Factor limiting the industrial application of Ti<sup>3</sup>

## Titanium

Resources: rich

➔ Rare metal?

Production: difficult

➔ Price

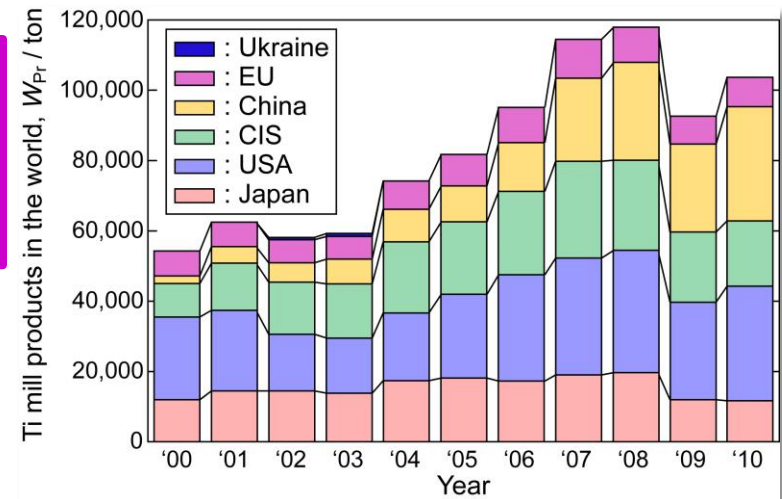
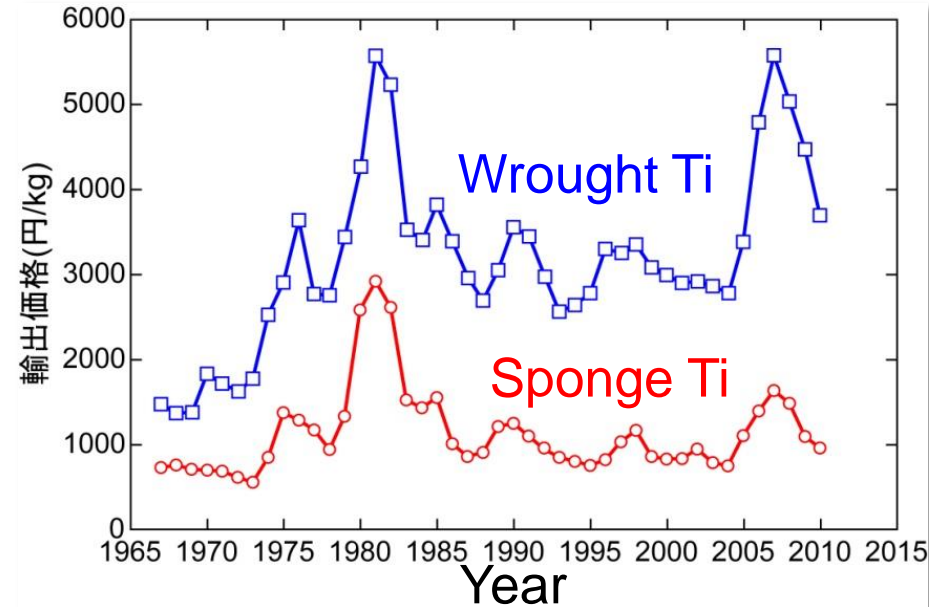
Sponge Ti: ¥1,000/kg

Wrought Ti: ¥3,000/kg

Much higher than stainless steels and aluminum alloys

Ti mill products shipments

~ 100,000 ton in the world



# Light elements in titanium

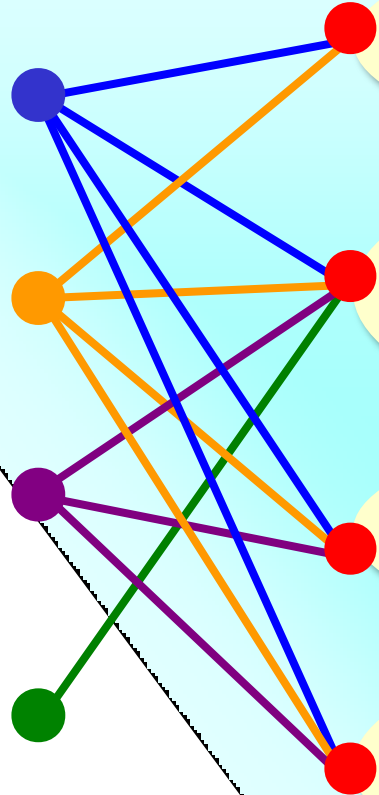
Hydrogen, Carbon, Nitrogen and Oxygen

High Chemical Affinity

High Solubility

Interstitially Soluble

Abundant and Cheap



## Smelting and Refining

Energy saving, Raw materials, Recycling  
Purification, Cleanliness

## Alloy Designing

Strength · elongation · ductility,  
Anisotropy, Elasticity, Workability,  
Shape memory · superelasticity

## Surface Function

Corrosion resistance, Wear resistance  
Photocatalytic activity, Biocompatibility

## Microstructural Control

Grain refinement, Precipitation  
Transformation, Temporary alloying,  
Mechanical properties

Cost reduction and High functionalization



Expansion of applications

*Thank you for your kind attention.*

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