



TOHOKU
UNIVERSITY

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Part 2, No. 30 (Poster No. 42)

Global/Local Innovations

for Next Generation Automobiles,

ICFD2013

Sendai, Japan

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

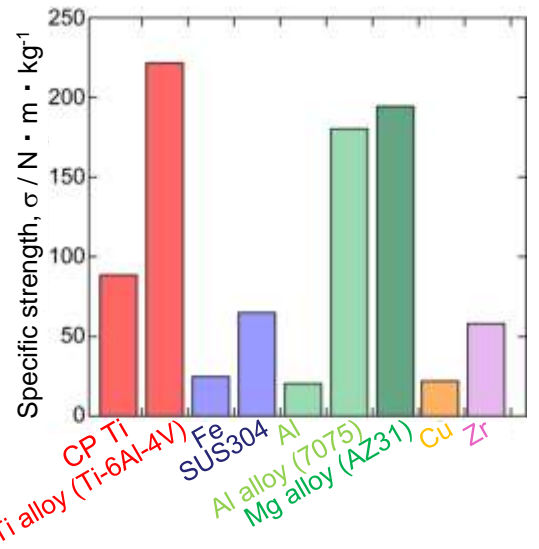
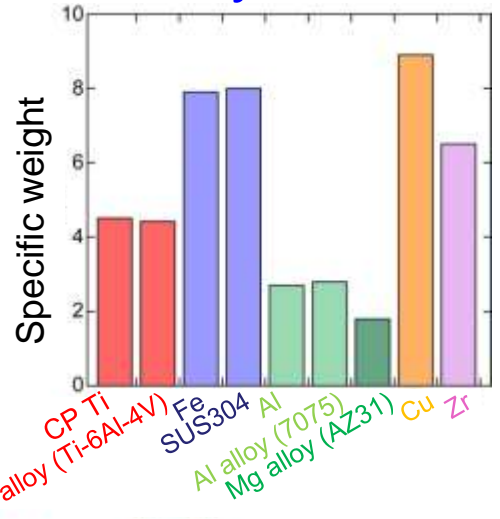
T. Narushima and K. Ueda

Department of Materials Processing,
Tohoku University, Sendai, Japan

Titanium: *wonder metal*

Low density: 60% of Fe-based alloys

Highest specific strength in metals



Light Weight

Allotropic Trans.

Chemical Reactivity

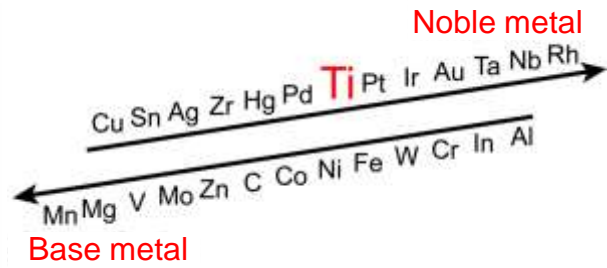
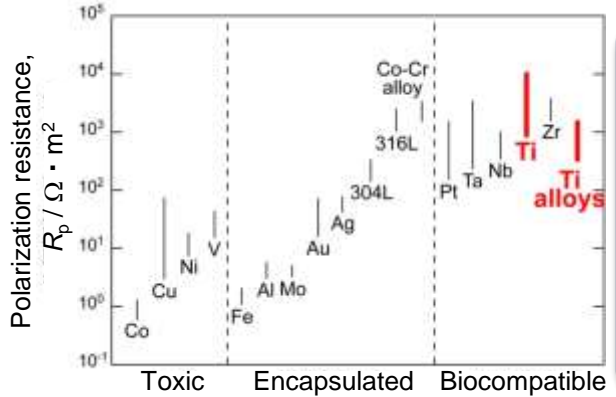
Biocompatibility

- Hypoallergenic
- Osseointegration

High corrosion resistance comparable to that of Pt



- **Space aeronautics**
- **Medical devices**
- **Military**
- **Chemical plants**



Factor limiting the industrial application of Ti

3

Titanium

Resources: rich

➔ Rare metals?

Production: difficult

➔ Price

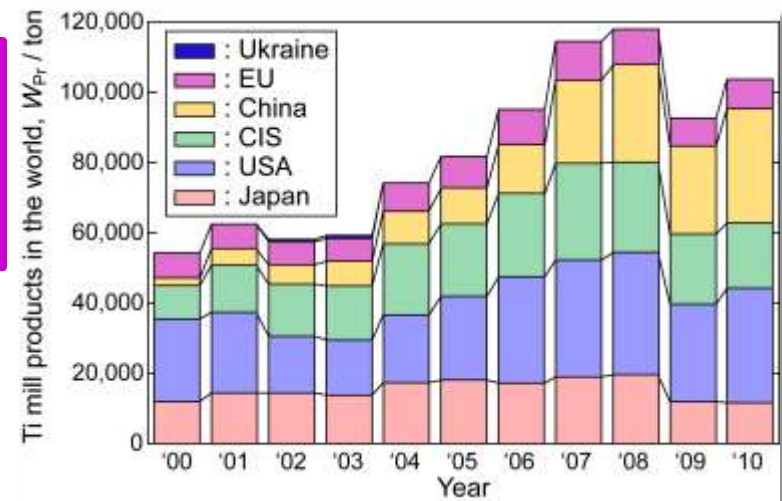
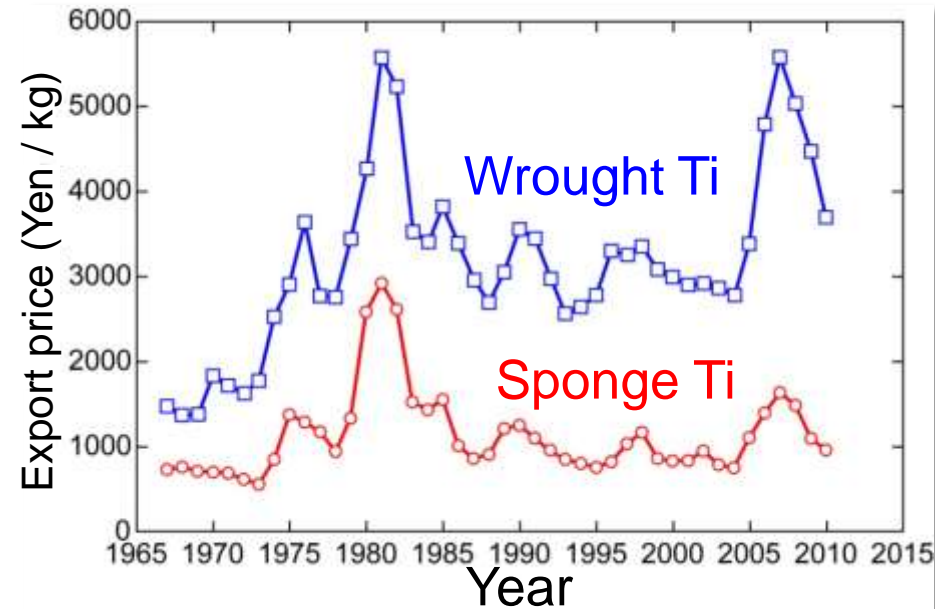
Sponge Ti: ¥1,000/kg

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

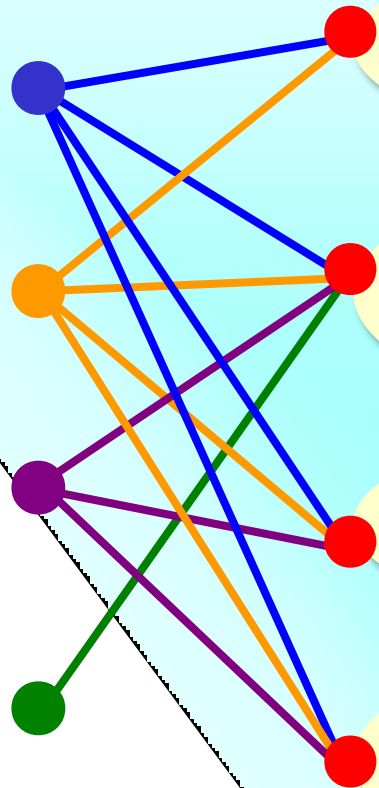
Hydrogen, Carbon, Nitrogen and Oxygen

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!

