MORITA LAB.

[Materials Processing for Sustainable Society]

International Research Center for Sustainable Materials

http://wood2.iis.u-tokyo.ac.jp

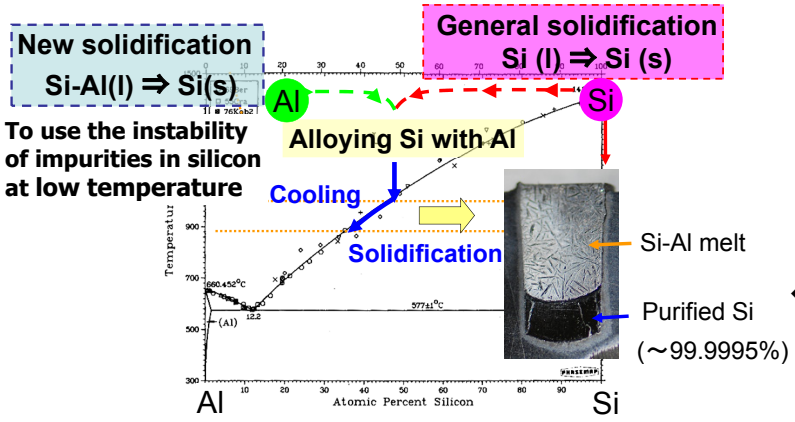
Materials Production and Recycling Engineering Lab.

Dept. Materials Engineering

We consider elementary materials, such as steel and silicon, as recycling materials, and aim at the establishment of environment-friendly society by developing their production and recycling processes together with by-product treatment. Physico-chemical studies for *Innovation of Iron- and Steel-making*, *Solar-Grade-Silicon Refining Processes* and *Enrichment of Waste Materials* are being carried out in our laboratory with consideration on thermodynamics and high temperature physical properties.

Development of Novel Refining Process for Solar Grade Si

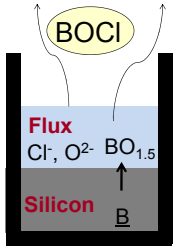
◆ **New concept refining by solidification**
– Low temperature purification using alloy solvent



◆ **Refining with reactive fluxes - I -**
– Removal of B by oxychloridation

- **Continuous removal of B into gas phase even with low flux/silicon distribution ratios of B**

$$B(l) + 3/4O_2(g) + Cl^-(\text{in slag}) \Rightarrow BOCl(g) + 1/2O^{2-}(\text{in slag})$$



◆ **Refining with reactive fluxes - II -**
– Reductive removal of P with CaO based fluxes

$$P(l) + 3/2O^{2-} \Rightarrow P^{3-}(\text{in slag}) + 3/4O_2(g)$$

High Temperature Physical Chemistry of Iron- and Steel-making Processes

◆ **Thermodynamics of minor elements in solid and molten steel**

◆ **Slag chemistry – physico-chemical properties and structural analysis**

Target

- **Optimization of refining process**
- **Heat recovery from molten slag**

⇒ **To construct the sustainable refining processes**

Research contents

➢ **Thermodynamics study of molten slag**

➢ **Thermal conductivity of slag**
(Determination by hot wire method)

Gradual cooling of steelmaking slag

➢ **Solid-state NMR spectroscopy for analyzing slag structure**

Atomic-molecular levels understanding and control of thermodynamic and physico-chemical properties of slag

NMR instrument
(JEOL ECA-500)

^{11}B MAS-NMR spectrum in CaO-SiO_2 slag

Boron changes its structure from trigonal to tetrahedral coordination with oxygen