IRCSEM

T. Yoshikawa LAB.

[Production of semiconductors from molten alloy – solution growth of next-generation semiconductor SiC and AlN]

Integrated Research Center for Sustainable Energy and Materials

Laboratory of High Temperature Sustainable Materials Processing

Dept. Materials Engineering

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Our laboratory tries to develop the innovative materials process ―
by combining high temperature physical chemistry (including thermodynamics and crystal growth)
with an original technique to visualize high temperature reacting interfaces.

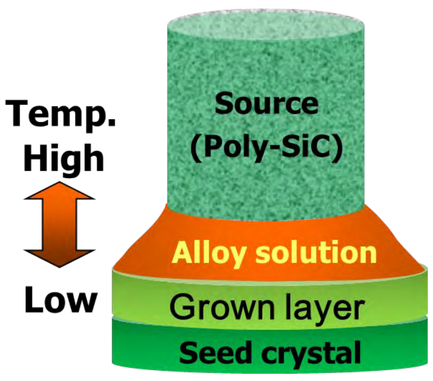
Solution growth of single crystals of wide-gap semiconductors

Wide-gap semiconductors such as silicon carbide (SiC) and aluminum nitride (AlN) are key materials to achieve the innovation in power conversion and optical devices. We are developing the rapid growth technique to produce their high quality single crystals.

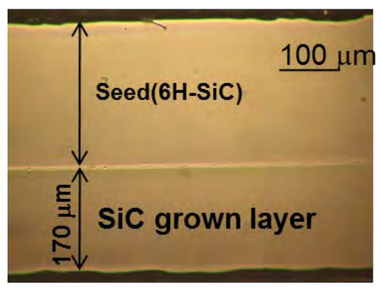
Control of reacting interface during steelmaking process

Tens or hundreds tons of molten steel react during steelmaking process, but the reaction proceeds thorough micron-scale phenomena. We try to contribute to the design of sustainable process for 21st century.

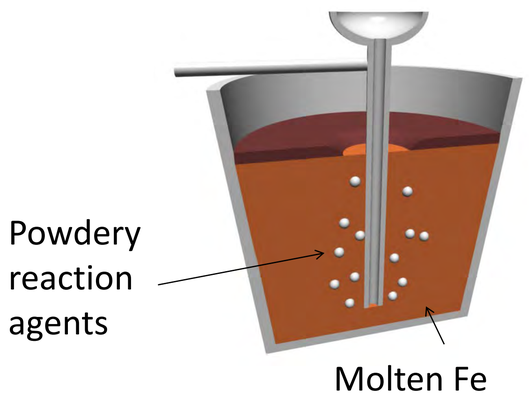
Low temperature rapid growth of SiC by the float zone method



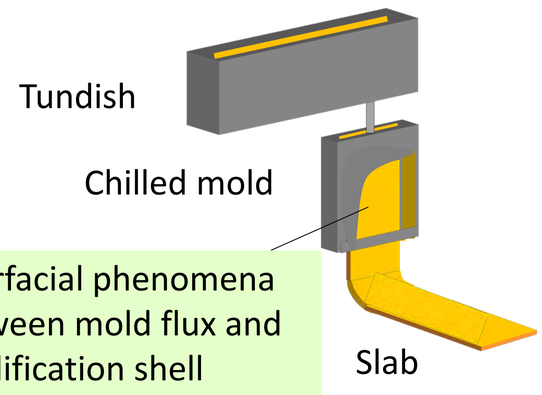
World's fastest growth below 1500℃



Reaction control between molten Fe and reaction agents



Microstructure control during the solidification in mold



Real-time observation of reacting interface at high temperature using visible light transmission

We carry out the in-situ observation of the high temperature interface of reacting couples using the transparency for visible light of the one phase such as SiC.

For example, we observed the growth interface during the solution growth of SiC for the first time in the world. We aim at establishing the optimal condition for the growth of high quality crystal of SiC based on the nano-scale observation of interfacial morphology and defects in grown crystals.

Dissolution interface at 1300℃

Growth interface during solution growth of SiC at 1400℃