Investigation of crystal growth mechanisms of Si crystals floating on Si melt and development of crystal growth technique to realize high-quality Si multicrystals

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【Outline of survey】

In face of serious environmental problems, large implementation of solar cells is pursued to ensure the sustainability of future energy supply. To accomplish this, a breakthrough technology to reduce the cost of electricity production by solar cells is mandatory. To reach the goal, establishment of novel crystal growth technology to realize Si multicrystals with high-quality and high-yield is essential.

In this research, we attempt to understand fundamental crystal growth mechanisms using originally developed in situ observation system of melt growth and model crystal growth experiments, and clarify how microstructures such as grain boundaries, grain orientations, and dislocations are formed during dynamical crystallization process. The obtained knowledge will be implemented to development of a novel crystal growth technology based on "floating casting method", which consists of nucleation at the center of the melt surface and subsequent crystal growth to minimize the contact of the crystal with the crucible wall. By this technology, we will realize high-quality Si multicrystals with low impurities and defects to be applicable to high-efficiency solar cells comparable with those based on single crystal.

【Expected results】

- Mechanisms of formation of microstructures and defects in Si multicrystals during dynamical crystallization process will be clarified through fundamental research of crystal growth.
- A novel crystal growth technology to realize high-quality Si multicrystals will be developed based on "floating cast method".
- By using the technology, Si multicrystals to be applicable to practical solar cells with high conversion efficiency of approximately 20% will be obtained.

【References by the principal investigator】

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【Term of project】 FY2008－2010	【Budget allocation】 **114,700,000 yen** (direct cost)

【Homepage address】 http://www.xtalphys.imr.tohoku.ac.jp