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Proposal of a neutron transmutation doping facility for n-type spherical silicon solar cell at high-temperature engineering test reactor

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Abstract

The p-type spherical silicon solar cell is a candidate for future solar energy with low fabrication cost, however, its conversion efficiency is only about 10%. The conversion efficiency of a silicon solar cell can be increased by using n-type silicon semiconductor as a substrate. This study proposed a new method of neutron transmutation doping silicon (NTD-Si) for producing the n-type spherical solar cell, in which the Si-particles are irradiated directly instead of the cylinder Si-ingot as in the conventional NTD-Si. By using a 'screw', an identical resistivity could be achieved for the Si-particles without a complicated procedure as in the NTD with Si-ingot. Also, the reactivity and neutron flux swing could be kept to a minimum because of the continuous irradiation of the Si-particles. A high temperature engineering test reactor (HTTR), which is located in Japan, was used as a reference reactor in this study. Neutronic calculations showed that the HTTR has a

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