

Conceptual Design of Neutron Transmutation Doping in Semiconductor Ingot for Uniformity of Depth Direction

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In these days, neutron transmutation doping (NTD) for the semiconductors such as silicon, silicon carbide, and etc. is one of the important technology of a research reactor. To product a high quality semiconductor ingot, the neutron reaction rate should be uniformly distribute in the ingot. In the previous studies, the rotation and screen methods are introduced. The rotation method can increase the uniformity of the radial reaction rate by rotating the irradiation device and the screen method can improve the uniformity of the axial reaction rate by using screen. However, the method to uniformize the reaction rate of the depth direction of the ingot is still not developed. Hence, conceptual design to optimize the reaction rate of the depth direction was proposed in this study. The idea of proposed concept is simply to create a slit that blocks neutrons coming in from outside without blocking them from entering the center. The sleeve of the irradiation hall and its internal structure have been changed because there is a real difficulty in putting the slit in a location other than the irradiation hall. Stainless steel, borated stainless steel and graphite were selected as the slit material. Among the materials, borated stainless steels shows the best results and theoretically confirmed that the ingot can have a uniform reaction rate. Therefore, it was expected that the proposed design can improve the quality of NTD.

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