

A neutron detector based on recoiled proton and MCP

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Abstract

A new neutron detector based on recoiled proton and micro channel plate has been developed for measurement of ultrafast pulse neutrons. The neutron sensitivity of the detector was investigated through simulation and experiment. A model of Monte Carlo simulation was set up for neutron sensitivity simulation. In this model, the yields and average energy of protons emitted from different thickness' polyethylene were calculated as a function of neutrons energy. Then, the yields of secondary electrons produced by the recoiled protons in micro channel of MCP were also calculated. The neutron sensitivity of the detector was finally obtained. The results show that the detector can achieve neutron sensitivity of more than $10^{-15} \text{ C}\cdot\text{cm}^2$ at the neutron energy above 1 MeV. Experiments were performed to test the neutron sensitivity on the K600 accelerator at Institution of Atomic Energy. The simulated results agreed with the experiments considering the uncertainties.

Key words: MCP, recoiled proton, secondary electron, neutron detector, neutron sensitivity