The calibration of the sensitivity to DD neutron for indium activation diagnostic

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Abstract:

The indium activation diagnostic was calibrated on an accelerator neutron source in order to diagnose DD neutron from inertial confinement fusion ICF. At the end of a continuous neutron irradiation, the activity of residual activated atoms in indium sample which is equivalent to that caused by transient irradiation is induced. The linear range of this activation diagnostic is determined by the relation between calibrated factor and neutron yield. A polyethylene shield with proper size designed by Monte Carlo simulation software is placed in front of indium sample to measure the downscattered neutron background of the accelerator room and correct the calibrated factor. The affect from some other activated nuclei on the calibration was verified by judging whether the measured curve obeys exponential decay and whether the half life of the decay agrees with the theoretic value. The calibration results shows that the linear range of this activation diagnostic can reach up to $5 \times 10^{12}$ neutron yields when a 7 cm diameter by 1 cm thick indium sample is placed at 40 cm distance from ICF implosion target, the calibrated factor is $4.52 \times 10^{-7}$ counts/n with an uncertainty of 4.3% and the possible interference nuclides have a negligible effect on the calibrated factor.