

Development of B and BN Thin Films for In-Situ Neutron Flux Monitoring

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Keywords: neutron depth profiling, neutron flux monitoring, MCNP, DPA, thin film

The KAERI-NDP (Korea Atomic Energy Research Institute-Neutron Depth Profiling) is for the quantification of the micro elements by measuring the prompt gamma or charged particle spectrums, which emitted by nuclear reaction between the neutron and target nucleus. The reaction rate depends on the target nucleus amounts, fractional yield, neutron absorption cross section and neutron flux.

The B and BN thin films were employed as a neutron flux monitor. The neutron flux can be estimated from the counting rate of the α particles, which is generated by $^{10}\text{B}(n, \alpha)^7\text{Li}$ reaction. The B and BN were deposited with 1 μm of thickness on the Si substrates. A value of thickness was determined by Monte Carlo simulation. To investigate the neutron damages of samples, B and BN samples were applied to MC-50 cyclotron at KIRAMS (Korea Institute of Radiological & Medical Sciences) for the fast neutron irradiation, which generated by $^9\text{Be}(p,n)^9\text{B}$ reaction. For the difference neutron fluences, three difference distances from the Be target were determined by calculation. The collision heating and DPA (Displacements Per Atom) by neutron irradiation were calculated to estimate the neutron damage. The temperature increments and DPA rates for the B and BN were within $\sim 10^{-7}$ °C and BN $\sim 10^{-15}$ dpa/sec. The AFM images of B and BN films showed no change by aerial exposure and neutron irradiation.

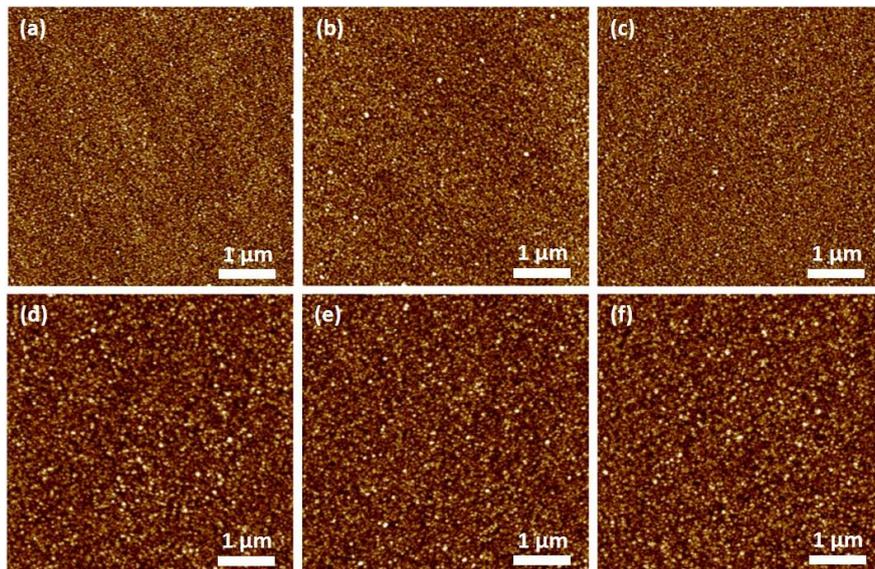


Fig. AFM images of B/Si and BN/Si thin films after neutron irradiation with different neutron fluences, which are inverse proportional to the distance between Be target and samples. AFM images of B thin films are shown in fig. (a), (b) and (c), which samples were irradiated by neutron with 2.01×10^{13} , 1.65×10^{12} and 2.70×10^{11} n/cm² of neutron fluences, respectively. A series of the AFM images for BN are shown from (d) to (f) with same order of neutron fluences for B samples ones.