

Radiation Effects on CCDs Induced by Neutron Beams at Atmosphere Neutron Irradiation Spectrometer of CSNS

Z.J. Wang¹, N. Tang², L.H. Mo³, Z.L. Hu³, S.X. Yan²

¹ *National Key Laboratory of Intense Pulsed Radiation Simulation and Effect, Northwest Institute of Nuclear Technology, Xi'an, 710024, China*

² *School of Materials Science and Engineering, Xiangtan University, Hunan, 411105, China*

³ *Spallation Neutron Source Science Center, Institute of High Energy Physics, Chinese Academy of Sciences (CAS)*

wangzujun@nint.ac.cn

Charge coupled devices (CCDs) exhibit many merits as solid imaging devices and are widely used in the radiation environments such as particle detection, space mission, medical imaging, and nuclear industry. However, the CCDs used in the radiation environments are sensitive to radiation damage. The neutron radiation effects on CCDs are still one of the major concerns of displacement radiation damage. The neutron radiation experiments were carried out at atmosphere neutron irradiation spectrometer (ANIS) of China spallation neutron source (CSNS) are presented. The CCDs were irradiated at the fluence of 1×10^{10} , 1×10^{11} , and 1×10^{12} n/cm². The degradations of the sensitive parameters such as the dark current, dark signal non-uniformity (DSNU), saturation output, dynamic range (DR), and signal to noise (SNR) induced by ANIS neutron beams at ANIS are analyzed. The degradations versus neutron fluence are presented. The annealing tests after irradiations are also performed. The degradation mechanisms of the sensitive parameters induced by neutron radiation damage are demonstrated. The research will provide the theories and experimental techniques for radiation damage evaluation of the array CCDs induced by neutron beams at ANIS of CSNS.