

Reactor neutrons damage induced in nanocrystalline anatase TiO_2 thin film, deposited by sol-gel on silicon substrate, was investigated by grazing angle X-ray diffraction (GAXRD), Raman spectroscopy, four-point probe and UV–visible spectrophotometry. After irradiation, the crystallinity of TiO_2 films improves and the electrical resistivity increases, due to an annealing effect associated with the reduction in oxygen vacancies in material. The observed change in the response of irradiated material at higher fluence, demonstrated by a slight reduction in the degree of crystallinity and electrical resistivity, testifies to the simultaneous presence of an annealing effect and a damaging effect during neutron irradiation. Moreover, the difference in the response of anatase and rutile phases of TiO_2 under neutron irradiation is explained by the difference in their crystalline structures and kinetic properties of defects. The optical band gap remains unchanged after irradiation meaning that no energy level has been produced within the forbidden region