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NiO thin films were deposited by RF magnetron sputtering method under 3–4 sccm O_2 (99.99%) in the O_2/Ar + O_2 flow rate at 450 °C substrate temperature at different RF powers and different thicknesses. The structural properties of NiO thin films were investigated using atomic force microscopy (AFM), x-ray diffraction (XRD) and x-ray Photoelectron Spectroscopy (XPS). The optical properties were studied by UV–vis spectroscopy and photoluminescence (PL) at room temperature. AFM studies show that the roughness parameters of the NiO surfaces are influenced by the film thickness and sputtering RF power. The XRD results revealed that as-prepared NiO films are polycrystalline and developed [111] preferred orientation. XPS study confirmed the presence of Ni^{2+} and Ni^{3+} ions in the NiO films. In the case of varying the thickness of the films at 210 W RF power, the optical band gap (E_g) values are 3.48 eV for 150 nm and 200 nm. For NiO films with 250 nm, 300 nm and 350 nm thicknesses, the E_g vary between 3.43 and 3.45 eV. PL spectra of the NiO thin films show bands emission in UV–vis region, which are affected by RF sputtering power.