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| Title | Significant reduction of defect states and surface tailoring in ZnO nanoparticles via nano-bio interaction with glucose for bio-applications | | |
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| Abstract |  |
| In this study, we have investigated the structural and optical properties of nanoconjugates (NJs) consisting of phase pure zinc oxide (ZnO) nanoparticles (NPs) with glucose biomolecules. All NJs were fabricated using a standard biochemical synthesis process. Structural, optical, vibrational, and biochemical interface properties of nano-bio composites are probed by different complementary characterization techniques. The XRD patterns of the NPs and NJs illustrate a highly phase pure ZnO structure. A visible green emission in the photoluminescence spectrum, mainly associated with the oxygen vacancies on the surface of ZnO nanostructure, is significantly reduced by the incorporation of glucose biomolecules. The strong binding interaction of glucose biomolecule on the surface of ZnO NPs results in the reduction in green-yellow-orange emission intensities. The interaction of glucose molecules modifies oxygen vacancies by capturing free electrons from the ZnO surface region. Significant changes in the peak intensity and relative peak position of some of the glucose and ZnO NPs in Raman spectra refer to the direct binding between these two nano- and bio-components. In the X-ray photoelectron spectroscopy, the binding energy of O 1s core level in NJs increases from 531 eV (O 1s core level position for ZnO) and the increment is more with higher initial glucose concentration in the solution during synthesis. This study serves as a promising platform for the development of new kinds of NJs and investigation of their interfacial properties which can take the frontier forward for integration and multifunctionality. | |