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Photo-activation of Ag chemicals for enhanced Nb2O5 optoelectronic device employing plasmonic effects

Abstract

This new work contributes to enhance the pulsed laser fabricated Nb2O5 nanostructures via silver (Ag) NPs plasmonic noble metal for the first time, for the best of our knowledge. Silver (Ag) NPs were incorporated into Nb2O5 nanomatrix structure by UV photo-activation mechanism of Nb2O5 immersed in AgNO3 for 5, 15, 25, 35, and 45 s, respectively. The results revealed that the optical band gap of Nb2O5 was reduced from 3.37 to 3.28 eV when silver (Ag) NPs were incorporated. Photoluminescence (PL) analyzes showed an enhanced Nb2O5 quality by showing defects reduction within the UV region (<375 nm) of the emission wavelengths. XRD analyzes revealed the successful decoration of silver (Ag)NPs into Nb2O5 nanostructure by showing silver diffraction planes at (200) and (111) among Nb2O5 diffraction planes. Surface-enhanced Raman spectroscopic (SERS) analyzes revealed an enhancement in the monoclinic (H–Nb2O5) at 1156.2 cm−1 demonstrating a successful hot electrons transfer.

Keywords

Immersion time; Nb2O5; Photochemical reduction; PLD; Silver (Ag) NPs