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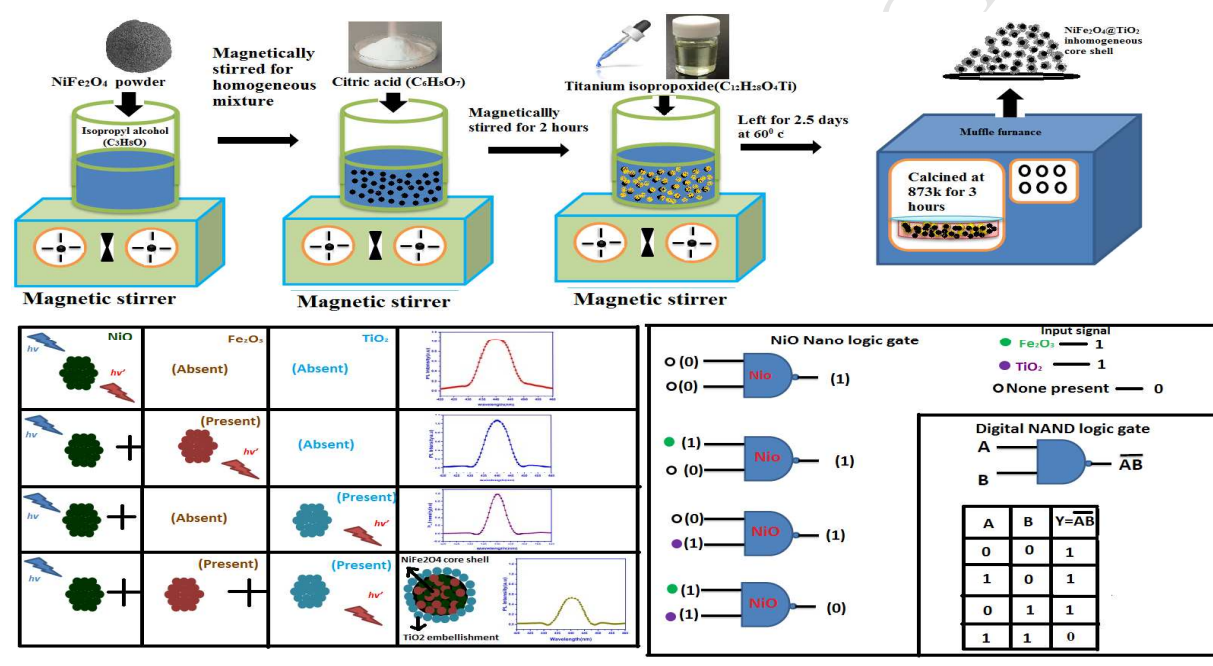
## Construction of core@shell nanostructured $\text{NiFe}_2\text{O}_4@\text{TiO}_2$ ferrite NAND logic gate using fluorescence quenching mechanism for $\text{TiO}_2$ sensing.

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### Graphical abstract



### Abstract

This study reports on the construction of nano nickel ferrite NAND logic gate utilizing the concept of fluorescence quenching mechanism due to its possible applications for the  $\text{TiO}_2$  sensor. Sol-gel auto combustion route and two-step synthesis procedures were adopted for synthesis and characterization of  $\text{NiO}$ ,  $\text{NiTiO}_3$ ,  $\text{NiFe}_2\text{O}_4$ , and novel magnetic core-shell  $\text{NiFe}_2\text{O}_4@\text{TiO}_2$ . The high crystalline phase formation, surface morphology and identical particle size formation (23-32nm) were confirmed from XRD, SEM and W-H plot respectively. The TEM micrographs of core-shell  $\text{NiFe}_2\text{O}_4@\text{TiO}_2$  reveals the inhomogeneous cages of  $\text{TiO}_2$  and unsymmetrical boundary around the magnetic  $\text{NiFe}_2\text{O}_4$  core. The optical band gap (determined from UV-DRS spectra using Kubelka-Munk equation) decreases significantly from  $\text{NiO}$  (3.94 eV) to  $\text{NiFe}_2\text{O}_4@\text{TiO}_2$  (1.84 eV) indicates enhanced semiconducting nature. The FTIR-ATR spectra spotlighted on the relaxation of the intrinsic metallic  $[\text{Ni}_{(\text{octa/tetra})}-\text{O}]$  stretching vibrations from  $\text{NiO}$  to  $\text{NiFe}_2\text{O}_4@\text{TiO}_2$  core-shell. The quenching intensity of photoluminescence (PL)

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