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Influence of Surface Kinetics and Induced Defects on Gas Sensing Characteristics of TiO2 nanostructures

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Over the years, a lot of researchers have invested their attention and time in investigating and improving chemical gas sensors as they have extensive applications in variety of fields such as air quality and environmental monitoring, mining, oil and automobile industry, food safety, medical diagnosis and monitoring. There is a high demand for accurate, fast, stable and portable devices that rises with technology advances and wide application fields. Enhanced sensitivity, fast response, total recovery, and good selectivity are the main characteristics of a good sensor. Titanium dioxide (TiO2) nanostructures display great potential as gas sensor due to the presence of intrinsic point defects such as oxygen vacancies (Ov) and Ti interstitials (Tii) which play a key role in enhancing the electrical, chemical and optical properties of the materials at the nanoscale. In this study, we report on the ultra-high sensitive and selective thermally treated TiO2 nanostructures synthesized via hydrothermal method. The findings displayed that as the annealing temperature increased, crystallinity improved and phase totally transformed from amorphous, anatase and pure rutile at 900 ˚C. Moreover the morphology transforms from spherical flower-like nanostructures to rod-like structure. BET surface area decreases with temperature however the porosity improves from mesoporous to microporous structures. XPS displayed improvement in Ti3+ and F+ centres which contribute to gas sensing properties towards volatile organic compounds (VOCs) hence we proposed sensing mechanism based on surface porosity and induced defects due to lattice expansion and contraction

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phd

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