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Study of phase development and thermal stability in as synthesized TiO₂ nanoparticles by laser pyrolysis: ethylene uptake and oxygen enrichment

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Highlights

- Mixed-phase oxygen abundant TiO₂ nanoparticles synthesised by Laser Pyrolysis
- Prevalent anatase stable phase with sizes superior to 30 nm
- Equally mixed phases TiO₂ with gradual turbostratic carbon content
- High rutile phase TiO₂ synthesis, exhibiting carbon impurities below 1%
- Good thermal stability for anatase titania above 750°C

Abstract

Laser pyrolysis has proven a viable and trustworthy method of TiO₂ nanoparticles fabrication, ensuring good quality and wide variety of nanoparticle morphologies and sizes. This work is aimed to phase control, experimentally studied, by parameter modulation, during one step laser pyrolysis synthesis or in combination with thermal annealing. High phase purity anatase and rutile TiO₂ nanoparticles, oxygen abundant, are synthesized from TiCl₄ and C₂H₄ gas mixtures, in the presence of air as oxygen donor, under CO₂ laser radiation. The nano-titania samples are analyzed by X-ray Diffraction, EDAX, TEM and Raman spectroscopy and reveal good phase stability and distinct morphology. This study extends the method applicability onto rutile majoritarian TiO₂ synthesis and generation of thermally stable anatase titania, a well-known catalyst.

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