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Narrowing band gap energy of defective black TiO₂ fabricated by solution plasma process and its photocatalytic activity on glycerol transformation

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1 **Narrowing band gap energy of defective black TiO₂ fabricated by solution plasma process and its**
2 **photocatalytic activity on glycerol transformation**

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12
13 **ABSTRACT**

14 Defective black titania (TiO₂) was synthesized by the solution plasma technique at ambient
15 temperature and pressure. The effects of the electrolyte solution medium type (KCl and HNO₃) and
16 concentration (0.3 and 3.0 mM) as well as the plasma discharge time (1-4 h) with a Ti electrode were
17 investigated. The 3.0 mM HNO₃ solution provided the highest energy per second discharging into the
18 plasma, resulting in both a high synthesis rate of black TiO₂ and a high degree of defective structures, as
19 monitored in terms of the Ti³⁺/Ti⁴⁺ ratio, which can shorten the band gap energy (E_g) of the obtained
20 black TiO₂. A long plasma discharge time (4 h) induced the formation of large particles of black TiO₂,
21 which appeared as a highly defective structure. Overall, the black TiO₂ prepared by discharged plasma for
22 4 h in 3.0 mM HNO₃ solution (BT_{N.304}) provided the highest photocatalytic activity for glycerol

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