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Hydrothermal syntheses of tungsten doped TiO_2 and TiO_2/WO_3 composite using metal oxide precursors for charge storage applications

Bhupender Pal [a], Bincy Lathakumary Vijayan [a], Syam G. Krishnan [a], Midhun Harilal [a], Wan Jeffrey Basirun [b], Adrian Lowe [c], Mashitah M. Yusoff [a], Rajan Jose [a, *]

[a] Nanostructured Renewable Energy Materials Laboratory, Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang, 26300, Kuantan, Malaysia
[b] Department of Chemistry, Faculty of Science, University of Malaya, 50603, Malaysia
[c] Research School of Engineering, Australian National University, Canberra, 0200, Australia

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ABSTRACT

Synthesis of advanced functional materials through scalable processing routes using greener approaches is essential for process and product sustainability. In this article, syntheses of nanoparticles of titanium dioxide (TiO_2), tungsten trioxide (WO_3), WO_3-doped titanium dioxide (W-TiO_2) and TiO_2/WO_3 composite at hydrothermal conditions using corresponding metal oxide precursors are described. Electrochemical charge storage capabilities of the above materials are measured using cyclic voltammetry, charge-discharge cycling and electrochemical impedance spectroscopy in aqueous KOH electrolyte. The TiO_2 and the WO_3 nanoparticle showed a specific charge (Q) of ~12 and ~36 mA h g^{-1} at a current density of 2 A g^{-1} in 6 M KOH, respectively. The Q of TiO_2 increased upon W doping up to 25 mA h g^{-1} for 5 wt% W-TiO_2 and the WO_3/TiO_2 composite showed the highest storage capability (Q ~40 mA h g^{-1}). Changes in the charge storage capabilities of the doped and composite materials have been correlated to materials properties.

* Corresponding author.
E-mail address: rjose@ump.edu.my (R. Jose).

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