

SINTESIS TITANIA-ZIRKONIA KOMPOSIT TERDOPING MANGAN SEBAGAI FOTOKATALIS POTENSIAL RESPONSIF SINAR TAMPAK DENGAN VARIASI KONSENTRASI MANGAN DAN TEMPERATUR KALSINASI

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INTISARI

TiO₂-ZrO₂ komposit terdoping Mn telah berhasil disintesis dan dikarakterisasi. Fotokatalis TiO₂-ZrO₂ komposit disintesis menggunakan metode sol-gel dan impregnasi. Tujuan dari penelitian ini adalah mempelajari bagaimana pengaruh konsentrasi dopan dan temperatur kalsinasi dalam proses sintesis terhadap sifat TiO₂-ZrO₂ komposit

Proses sintesis dilakukan dengan melakukan hidrolisis TTIP pada suspensi ZrO₂ dan dopan mangan dengan konsentrasi mangan 1, 3, 5, 7, 9% (b/b Ti). TiO₂ terdoping Mn akan ditumbuhkan pada permukaan ZrO₂. Fotokatalis dikalsinasi pada temperatur 500, 700, 900 °C. TiO₂ dan ZrO₂ terdoping mangan juga disintesis sebagai material pembanding. Sampel fotokatalis TiO₂-ZrO₂ komposit dan pembandingnya dikarakterisasi menggunakan *X-Ray Diffractometer* (XRD), *Scanning Electron Microscopy dengan Energy Dispersive X-Ray* (SEM-EDX), *Fourier Transform Infrared Spectrophotometer* (FT-IR) dan *Specular Reflectance UV-Visible Spectrophotometer* (SR-UV).

Berdasarkan hasil analisis XRD struktur komposit yang terbentuk pada temperatur kalsinasi 500 °C adalah *anatase* dan monoklin. Setelah mengalami kalsinasi pada temperatur 700 °C dan 900 °C ZrO₂ struktur yang terbentuk adalah *anatase*, *rutile* dan monoklin. SEM-EDX menunjukkan permukaan komposit memiliki komposisi Zr sebesar 49,09%, O sebesar 32,42%, Ti sebesar 18,16%, Mn sebesar 0,33%. Karakterisasi FT-IR menunjukkan adanya vibrasi disekitar daerah bilangan gelombang 400-650 cm⁻¹ yang menunjukkan ikatan Zr-O, Ti-O, dan Mn-O. Spektra serapan SRUV menunjukkan pergeseran merah pada material fotokatalis terhadap berbagai konsentrasi dopan mangan dan temperatur kalsinasi. Fotokatalis potensial dihasilkan pada sintesis dengan konsentrasi dopan 7% dan temperatur kalsinasi 500 °C.

Kata Kunci: ZrO₂-TiO₂, Fotokatalis, Konsentrasi, Sol-gel, Temperatur kalsinasi, Dopan mangan.

***SYNTHESIS OF MANGAN DOPED TITANIA-ZIRCONIA COMPOSITE
AS POTENTIAL VISIBLE-RESPONSIVE PHOTOCATALYST WITH
VARIOUS MANGAN CONCENTRATIONS AND CALCINATION
TEMPERATURES***

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ABSTRACT

Mn-doped $\text{TiO}_2\text{-ZrO}_2$ composite has been successfully synthesized and characterized. $\text{TiO}_2\text{-ZrO}_2$ Composite photocatalyst was synthesized using sol-gel and impregnation methods. The purpose of this research was to study the effect of dopant concentration and calcination temperature in the synthesis process of the properties $\text{TiO}_2\text{-ZrO}_2$ composite.

The synthesis process was carried out by hydrolyzed TTIP into suspension of aqueous ZrO_2 and manganese, with various manganese concentrations of 1, 3, 5, 7, 9% (w/w Ti). Mn-doped TiO_2 was grown on the surface of ZrO_2 . The photocatalyst then calcined at temperatures of 500, 700, 900 °C. Mn-doped ZrO_2 and TiO_2 was also synthesized as reference. Photocatalyst sample of composite $\text{TiO}_2\text{-ZrO}_2$ and its references were characterized-by using X-Ray Diffractometer (XRD), Scanning Electron Microscopy with Energy Dispersive X-Ray (SEM-EDX), Fourier Transform Infrared Spectrophotometer (FT-IR) and Specular Reflectance UV-Visible Spectrophotometer (SR-UV).

The XRD result showed structure of $\text{TiO}_2\text{-ZrO}_2$ composite after calcination at 500 °C was anatase and monoclinic. After calcination at temperatures 700 °C and 900 °C the structure of photocatalyst was anatase, rutile and monoclinic. SEM-EDX shows the composite surface has a composition of Zr of 49.09%, O of 32.42%, Ti of 18.16%, and Mn of 0.33%. FT-IR characterization showed the presence of vibrational around wavenumber $400\text{-}650\text{ cm}^{-1}$ which shows Zr-O, Ti-O, and Mn-O bonds. SRUV absorption spectra showed red shift of photocatalyst material, towards various manganese dopant concentrations and calcination temperatures. The band gap energy decreases until optimum point. Potential photocatalyst was synthesized with a dopant concentration of 7% and a calcination temperature of 500 C.

Keywords: $\text{ZrO}_2\text{-TiO}_2$, concentration, calcination temperature, photocatalyst, sol-gel, Manganese