

SINTESIS Cu-DOPED ZrTiO₄ DENGAN VARIASI PERSENTASE Cu DAN SUHU KALSINASI SEBAGAI MODEL FOTOKATALIS RESPONSIF SINAR TAMPAK

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INTISARI

Sintesis dan karakterisasi Cu-doped ZrTiO₄ sebagai model fotokatalis responsif terhadap sinar tampak telah dilakukan. Tujuan penelitian ini adalah mendapatkan material Cu-doped ZrTiO₄ melalui sintesis dengan metode sol-gel, mengetahui pengaruh variasi persentase CuSO₄·5H₂O sebagai prekursor dopan dan suhu kalsinasi untuk menghasilkan material Cu-doped ZrTiO₄ yang responsif terhadap sinar tampak. Penelitian diawali dengan membuat prekursor TiO₂ dari Titanium tetraisopropoksida (TTIP) dan etanol, kemudian direaksikan dengan ZrO₂ dan garam CuSO₄·5H₂O dengan variasi persentase 0, 1, 3, 5, 7 dan 9% (b/b). Pada setiap persentase CuSO₄·5H₂O divariasikan suhu kalsinasinya pada 500, 700 dan 900 °C. Sebagai eksperimen kontrol, material Cu-doped ZrO₂ disintesis menggunakan metode refluks. Material yang diperoleh dikarakterisasi dengan X-Ray Diffraction (XRD), Scanning Electron Microscopy dengan Energy Dispersive X-Ray (SEM-EDX), Fourier Transform Infra Red Spectrophotometer (FTIR) dan Specular Reflectance UV-Visible Spectrophotometer (SRUV).

Hasil analisis XRD menunjukkan kestabilan termal yang lebih baik pada karakter Cu-doped ZrO₂ dibandingkan dengan Cu-doped ZrTiO₄ dilihat dari proses perubahan fase. Ukuran kristal optimum Cu-doped ZrTiO₄ yang diperoleh sebesar 45,11 nm. Hasil SEM-EDX menunjukkan komposisi unsur Cu 3,31%, Ti 23,02%, O 38,44% dan Zr 35,22% serta material Cu-doped ZrTiO₄ memiliki homogenitas tinggi. Spektra IR menunjukkan perubahan pada struktur kristal yang ditandai dengan perubahan intensitas persen transmitansi ikatan Ti-O-Ti. Analisis dengan SRUV menunjukkan adanya penurunan nilai E_g yang mencapai kondisi optimum pada penambahan garam dopan CuSO₄·5H₂O sebanyak 5% (b/b) pada suhu kalsinasi 500 °C. Nilai E_g optimum yang diperoleh sebesar 2,87 eV pada daerah panjang gelombang sinar tampak 431,93 nm.

Kata kunci: Cu-doped ZrTiO₄, fotokatalis, kalsinasi, sol-gel, variasi persentase

SYNTHESIS OF Cu-DOPED ZrTiO₄ WITH VARIOUS PERCENTAGE OF Cu AND CALCINATION TEMPERATURES AS A MODEL OF VISIBLE-LIGHT RESPONSIVE PHOTOCATALYST

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ABSTRACT

Synthesis and characterization of Cu-doped ZrTiO₄ as a model of visible light responsive photocatalyst have been conducted. The purposes of this research were to get Cu-doped ZrTiO₄ materials by sol-gel method, the effect of various CuSO₄·5H₂O concentration as dopant precursor and calcination temperature of Cu-doped ZrTiO₄ material as a model of visible light responsive photocatalyst. The research was initiated by making TiO₂ precursor from Titanium tetraisopropoxide (TTIP) and ethanol, then reacted with mixture of ZrO₂ and CuSO₄·5H₂O salt in various percentage 0, 1, 3, 5, 7 and 9% (w/w). The variant concentration of CuSO₄·5H₂O was calcinated in various temperature of 500, 700 and 900 °C. The control process, Cu-doped ZrO₂ material was synthesized by reflux method. The samples were characterized with X-Ray Diffraction (XRD), Scanning Electron Microscopy with Energy Dispersive X-Ray (SEM-EDX), Transform Infrared Spectrometer (FTIR) and Specular Reflectance UV-Visible Spectrophotometer (SRUV).

The XRD results showed that the character of Cu-doped ZrO₂ has better thermal stability than Cu-doped ZrTiO₄ seen from the phase change process. The optimum crystal size of Cu-doped ZrTiO₄ was 45.11 nm. SEM-EDX results showed the elements composition of Cu 3,31%, Ti 23,02%, O 38,44% and Zr 35,22% with high homogeneity of Cu-doped ZrTiO₄ materials. IR spectra showed change in crystalline structure with intensity change of Ti-O-Ti transmittance in Cu-doped ZrTiO₄. SRUV analysis showed that the optimum of decrease bandgap energy (E_g) was on 5% of CuSO₄·5H₂O dopant at a temperature of 500 °C. The optimum bandgap energy (E_g) was 2.87 eV in the visible-light wavelength absorption at 431.93 nm.

Keywords: calcination temperature, Cu-doped ZrTiO₄, photocatalyst, sol-gel, various percentage