SINTESIS Fe-*DOPED* ZrO_2 SEBAGAI MODEL FOTOKATALIS RESPONSIF SINAR TAMPAK MENGGUNAKAN VARIASI KONSENTRASI GARAM $FeSO_4 \cdot 7H_2O$ DAN SUHU KALSINASI

Bawesti Lakstiarini
14/364445/PA/16015

INTISARI

Sintesis dan karakterisasi Fe-*doped* ZrO_2 sebagai model fotokatalis responsif sinar tampak telah dilakukan. Dalam penelitian ini dipelajari karakter Fe-*doped* ZrO_2 hasil sintesis dengan metode refluks, pengaruh variasi konsentrasi $FeSO_4 \cdot 7H_2O$ sebagai dopan dan pengaruh suhu kalsinasi pada sintesis Fe-*doped* ZrO_2 sebagai model fotokatalis responsif sinar tampak yang ditandai dengan menurunnya energi celah pita (E_g). Penelitian ini diawali dengan mereaksikan ZrO_2 dan garam $FeSO_4.7H_2O$ dengan variasi konsentrasi 1, 3, 5, 7 dan 9% (b/b) menggunakan metode refluks kemudian dikalsinasi pada suhu 500, 600, 700, 800, 900 dan 1000 °C. Sampel yang diperoleh kemudian dikarakterisasi menggunakan spektrofotometer difraktometer sinar-X (XRD), *Scanning Electron Microscopy with Energy Dispersive X-Ray* (SEM EDX), spektrofometer *Fourier Transform Infrared* (FT-IR), dan spektrofotometer *Specular Reflectance UV-Visible* (SR-UV).

Hasil analisis XRD menunjukkan bahwa material Fe-*doped* ZrO_2 seluruhnya fase kristal monoklinik dan intensitas serapannya semakin menurun seiring dengan penambahan dopan Fe. Ukuran kristal Fe-*doped* ZrO_2 rata-rata sebesar 55,75 nm. Keberadaan Fe terkonfirmasi dari data EDX dengan diperoleh komposisi Fe, Zr, dan O sebesar 0,60; 70,75; dan 28,65%. Hasil spektra IR menunjukkan terjadi pergeseran puncak ke arah bilangan gelombang yang lebih kecil pada bilangan gelombang 400-750 cm^{-1} yang mengindikasikan keberadaan Fe telah mengganggu ikatan Zr-O-Zr. Analisis dengan SR-UV menunjukkan penurunan optimum material Fe-*doped* ZrO_2 pada konsentrasi 7% (b/b) dengan nilai E_g sebesar 2,94 eV dan 2,96 eV pada suhu kalsinasi 500 dan 1000 °C.

Kata kunci: E_g, Fe-*doped* ZrO_2, Fotokatalis, Zirkonia

SYNTHESIS OF Fe-DOPED ZrO_2 AS A MODEL OF VISIBLE-LIGHT RESPONSIVE PHOTOCATALYST USING VARIOUS CONCENTRATIONS OF $FeSO_4 \cdot 7H_2O$ SALT AND CALCINATION TEMPERATURES

Bawesti Lakstiarini
14/364445/PA/16015

ABSTRACT

Synthesis and characterization of Fe-doped ZrO_2 as a model of visible-light responsive photocatalyst have been conducted. The purpose of this research were to study the character of Fe-doped ZrO_2 by reflux method, to study the effect of various concentrations on the addition of $FeSO_4.7H_2O$ as a dopant and the effect temperature used in calcination process on its responsiveness under visible-light characterized by decreasing bandgap energy (E_g). This research was initiated by the reaction of ZrO_2 and various concentrations of 1, 3, 5, 7, and 9% (w/w) of $FeSO_4.7H_2O$ using reflux method and the product was calcinated at various temperatures 500, 600, 700, 800, 900 and 1000 °C. All samples were characterized with X-Ray Diffractometer (XRD), Scanning Electron Microscopy with Energy Dispersive X-Ray (SEM EDX), Fourier Transform Infrared spectrophotometry (FT-IR), and Specular Reflectance UV-Visible spectrophotometry (SR-UV).

The XRD results showed that the Fe-doped ZrO_2 material was monoclinic crystalline phase and its absorption intensity decreased along with the addition of Fe as a dopant. The average crystal size of Fe-doped ZrO_2 was 55.75 nm. The presence of Fe was confirmed from EDX, that is Fe-doped ZrO_2 contains 0.60% of Fe, 70.75% of Zr, and 28.65% of O. IR spectra of the synthesized materials showed a reducing absorption on 400-750 cm^{-1}, indicating that the presence of Fe has disrupted the Zr-O-Zr bond. SR-UV showed that the optimum decrease of E_g (band gap energy) was formed on Fe-doped ZrO_2 concentration of 7%, giving an E_g value of 2.94 eV and 2.96 eV at calcination temperatures of 500 and 1000 °C, respectively.

Keywords: E_g, Fe-*doped* ZrO_2, Photocatalyst, Zirconia