

PENGARUH KONSENTRASI $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$ DAN SUHU KALSINASI PADA SINTESIS Ni-DOPED $\text{TiO}_2\text{-ZrO}_2$ SEBAGAI MODEL FOTOKATALIS RESPONSIF SINAR TAMPAK

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INTISARI

Telah dilakukan penelitian pengaruh variasi konsentrasi $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$ dan suhu kalsinasi pada sintesis fotokatalis Ni-doped $\text{TiO}_2\text{-ZrO}_2$ sebagai model fotokatalis responsif sinar tampak. Tujuan dari penelitian ini adalah melakukan sintesis Ni-doped $\text{TiO}_2\text{-ZrO}_2$ serta mempelajari pengaruh variasi konsentrasi $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$ sebagai prekursor dopan dan suhu kalsinasi pada sintesis Ni-doped $\text{TiO}_2\text{-ZrO}_2$ sebagai model fotokatalis yang responsif terhadap sinar tampak.

Metode yang digunakan dalam penelitian ini adalah metode *sol-gel*. Prekursor Titanium Tetraisopropoksida (TTIP) dicampurkan ke dalam etanol lalu ditambahkan ZrO_2 dan garam $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$. Campuran disentrifugasi, didiamkan, kemudian dikeringkan dalam oven selama 24 jam, kemudian dikalsinasi selama 4 jam. Hasil sintesis dikarakterisasi menggunakan *Fourier Transform Infrared Spectrophotometer* (FT-IR), *Specular Reflectance UV-Visible Spectrophotometer* (SR-UV), *X-Ray Diffractometer* (XRD), dan *Scanning Electron Microscopes-energy dispersive X-ray* (SEM-EDX).

Hasil karakterisasi kristal menggunakan XRD menunjukkan kestabilan termal kristal Ni-doped $\text{TiO}_2\text{-ZrO}_2$ yang lebih baik, dilihat pada proses perubahan fasa *anatase* ke *rutile*. Didapatkan rerata ukuran optimum kristal Ni-doped $\text{TiO}_2\text{-ZrO}_2$ sebesar 34,19 nm. Hasil analisis menggunakan SEM-EDX menunjukkan kristal Ni-doped $\text{TiO}_2\text{-ZrO}_2$ memiliki homogenitas yang tinggi dengan komposisi Ni, Zr, Ti dan O masing-masing sebesar 1,33; 21,38; 31,71; dan 45,58%. Pada spektra IR terdapat perubahan intensitas transmisi pada bilangan gelombang 400-1200 cm^{-1} yang mengindikasikan keberadaan Ni telah mengganggu ikatan Ti-O-Ti. Hasil karakterisasi menggunakan SR-UV menunjukkan bahwa adanya penurunan nilai E_g pada material Ni-doped $\text{TiO}_2\text{-ZrO}_2$ dengan konsentrasi optimum sebesar 5% dengan nilai E_g sebesar 2,90 eV pada panjang gelombang 427,26 nm.

Kata kunci: fotokatalis, Ni-doped $\text{TiO}_2\text{-ZrO}_2$, variasi konsentrasi, suhu kalsinasi, *sol-gel*

**THE INFLUENCE OF $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$ CONCENTRATION AND
CALCINATION TEMPERATURE ON THE SYNTESIS OF Ni-DOPED
 $\text{TiO}_2\text{-ZrO}_2$ AS A MODEL OF VISIBLE RESPONSIVE PHOTOCATALYST**

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ABSTRACT

The influence of $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$ concentrations and calcination temperature in the synthesis of Ni-doped $\text{TiO}_2\text{-ZrO}_2$, as a material of visible responsive photocatalyst had been done. The purposes of this experiment were to synthesize Ni-doped $\text{TiO}_2\text{-ZrO}_2$ and to study the influence of variation Ni concentration as dopant precursor and calcination temperature on synthesis of Ni-doped $\text{TiO}_2\text{-ZrO}_2$ as material of visible responsive photocatalyst.

The method used in this experiment was sol-gel method. Titanium Tetraisopropoxide (TTIP) precursor was diluted with ethanol then $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$ salt and ZrO_2 were added to the precursor mixture. The mixture was centrifuged, dry in the oven for 24 hours, and calcined for 4 hours. The resulted material were characterized with Fourier Transform Infrared Spectrophotometer (FT-IR), Specular Reflectance UV-Visible Spectrophotometer (SR-UV), X-Ray Diffractometer (XRD), and Scanning Electron Microscopes (SEM).

The results of crystal characterization using XRD showed that the thermal stability of Ni-doped $\text{TiO}_2\text{-ZrO}_2$ crystals was better, compared to Ni-doped ZrO_2 crystals, seen in the process of changing the anatase to rutile phase. The average optimum crystal size of Ni-doped $\text{TiO}_2\text{-ZrO}_2$ was 34,19 nm. The results of the analysis using SEM-EDX showed that the Ni-doped $\text{TiO}_2\text{-ZrO}_2$ crystals had high homogeneity with the compositions of Ni, Zr, Ti and O respectively 1,33; 21,38; 31,71; and 45,58%. In the IR spectra there is a change in the intensity of the transmittance at a wave number of $400\text{-}1200\text{ cm}^{-1}$ which indicates the presence of Ni has disrupted the Ti-O-Ti bond. The results of characterization using SR-UV showed that there was a decrease in the E_g value of the Ni-doped $\text{TiO}_2\text{-ZrO}_2$ material with an optimum concentration of 5% with an E_g value of 2,90 eV at a wavelength of 427,26 nm.

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