

SINTESIS Co-DOPED ZrTiO₄ DENGAN VARIASI KONSENTRASI Co DAN SUHU KALSINASI MENGGUNAKAN METODE SOL-GEL SEBAGAI MODEL FOTOKATALIS RESPONSIF SINAR TAMPAK

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INTISARI

Sintesis Co-doped ZrTiO₄ dengan metode sol-gel sebagai model fotokatalis responsif sinar tampak telah berhasil dilakukan. Tujuan dari penelitian ini adalah melakukan sintesis Co-doped ZrTiO₄ dengan metode sol-gel, mengetahui pengaruh variasi konsentrasi dopan Co, serta pengaruh suhu kalsinasi pada sintesis Co-doped ZrTiO₄ sebagai model fotokatalis yang responsif terhadap sinar tampak. Penelitian dilakukan dengan melarutkan titanium tetraisopropoksida (TTIP) dan etanol, kemudian direaksikan dengan ZrO₂ dan garam CoSO₄·7H₂O dengan variasi konsentrasi 0, 1, 3, 5, 7, dan 9% (b/b) yang sudah dilarutkan dalam akuabides. Campuran disentrifugasi, padatan yang diperoleh dikeringkan dalam oven selama 24 jam. Material dengan variasi konsentrasi dopan Co dikalsinasi selama 4 jam dengan suhu 500 °C, sementara material dengan konsentrasi dopan Co 5% dikalsinasi dengan suhu 700 °C dan 900 °C. Material hasil sintesis kemudian dikarakterisasi menggunakan *Fourier Transform Infrared Spectrophotometer* (FT-IR), *Specular Reflectance UV-Visible Spectrophotometer* (SR-UV), *X-Ray Diffractometer* (XRD), dan *Scanning Electron Microscopy* dengan *Energy Dispersive X-Ray* (SEM-EDX).

Hasil XRD menunjukkan material hasil sintesis memiliki fase kristal monoklinik dan *anatase* pada suhu kalsinasi 500 °C. Semakin tinggi suhu kalsinasi menyebabkan terjadinya perubahan fase dari *anatase* ke *rutile*. Spektra EDX menunjukkan bahwa dopan Co berhasil terdoping dalam material kristal. Spektra IR menunjukkan perubahan serapan ikatan Ti-O-Ti yang menandakan adanya perubahan pada struktur kristal. Analisis dengan SRUV menunjukkan seluruh material hasil sintesis memiliki E_g yang lebih rendah daripada TiO₂, dengan nilai E_g terendah yang diperoleh sebesar 2,78 eV pada Co-doped TiO₂ 1% dengan suhu kalsinasi 500 °C.

Kata Kunci: Co-doped ZrTiO₄, fotokatalis, konsentrasi, sol-gel, suhu kalsinasi

SYNTHESIS OF Co-DOPED ZrTiO₄ WITH VARIOUS CONCENTRATIONS OF Co AND CALCINATION TEMPERATURES BY SOL-GEL METHOD AS A MODEL OF VISIBLE-LIGHT RESPONSIVE PHOTOCATALYST

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ABSTRACT

Synthesis of Co-doped ZrTiO₄ by sol-gel method as a model photocatalyst with visible-light response had been conducted. Purposes of this research were to get synthesize Co-doped ZrTiO₄ by sol-gel method, the effect of various Co dopant concentration and calcination temperatures on the characteristic of Co-doped ZrTiO₄. This research was initiated by dissolve Titanium tetraisopropoxide (TTIP) and ethanol, then reacted with ZrO₂ and CoSO₄·7H₂O with various concentrations 0, 1, 3, 5, 7, and 9% (w/w) which dissolved in demineralized water. The mixture was separated by centrifugation, then the obtain solid dried in an oven for 24 h. Materials with various Co dopant contents were calcined at 500 °C for 4 h and materials with 5% dopant content were calcined at 700 °C and 900 °C. All samples were characterized by using Fourier Transform Infrared Spectrophotometer (FT-IR), Specular Reflectance UV-Visible Spectrophotometer (SR-UV), X-Ray Diffractometer (XRD), and Scanning Electron Microscopy with Energy Dispersive X-Ray (SEM-EDX).

The XRD results after 500 °C calcination showed that synthesized materials were dominated by monoclinic and anatase phase. The higher calcination temperature caused phase transformation from anatase to rutile. EDX spectra shows that Co dopant was succesfully doped in ZrTiO₄ crystal. IR spectra showed change in the absorption of Ti-O-Ti bonds that indicate change in the crystalline structure. Based on the SRUV results, all synthesized materials showed lower bandgap than TiO₂, with the lowest bandgap was 2.78 eV was achieved on Co-doped TiO₂ 1% after calcination at 500 °C.

Keywords: Co-doped ZrTiO₄, concentration, calcination temperature, photocatalyst, sol-gel