

Sintesis dan Karakterisasi Oksida Perovskit $\text{CaFe}_{0.8}\text{Mg}_{0.2-x}\text{Zn}_x\text{O}_3$ ($x=0-0,2$): Studi Perilaku Desorpsi Oksigen = Synthesis and Characterization of Low-Cost $\text{CaFe}_{0.8}\text{Mg}_{0.2-x}\text{Zn}_x\text{O}_3$ ($x= 0-0.2$) Perovskite Oxide: Study on Oxygen Desorption Properties

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Abstrak

Pada penelitian ini, material oksida perovskit CaFeO_3 (CF), $\text{CaFe}_{0.8}\text{Mg}_{0.2}\text{O}_3$ (CFM-82), $\text{CaFe}_{0.8}\text{Mg}_{0.1}\text{Zn}_{0.1}\text{O}_3$ (CFMZ-811), dan $\text{CaFe}_{0.8}\text{Zn}_{0.2}\text{O}_3$ (CFZ-82) telah disintesis menggunakan metode reaksi padat dan dipreparasikan sebagai membran dengan metode dry-pressing. Fe_2O_3 yang digunakan sebagai prekursor didapatkan dari pengolahan limbah mill scale dan semua prekursor dievaluasi kemurniannya menggunakan instrumentasi X-Ray Fluorescence (XRF). Perilaku desorpsi gas O_2 dari serbuk oksida perovskit dievaluasi menggunakan instrumentasi Temperature-Programmed Desorption of Oxygen (O_2 -TPD). Nilai kapasitas adsorpsi oksigen (mmol/g) menurun sesuai urutan berikut: CFM-82 > CFMZ-811 > CFZ-81 > CF. Data O_2 -TPD selanjutnya digunakan dalam estimasi nilai oxygen vacancies. Struktur kristal dari serbuk oksida perovskit dievaluasi menggunakan instrumentasi X-Ray Diffraction (XRD) dan analisa Rietveld refinement dilakukan menggunakan software HighScore PlusTM. Konfirmasi stoikiometrik dari serbuk oksida perovskit dievaluasi menggunakan instrumentasi XRF. Densitas dan porositas membran perovskit dievaluasi menggunakan metode Archimedes. Kekuatan struktural dari membran perovskit dievaluasi menggunakan uji kekerasan Vickers dengan penurunan nilai Vicker Hardness sebagai berikut: CFM-82 > CFZ-81 > CF > CFMZ-811. Studi perilaku desorpsi oksigen dari oksida perovskit CF, CFM-82, CFMZ-811, dan CFZ-82 pada penelitian ini dilakukan untuk mengevaluasi potensi keempat material tersebut sebagai membran transport oksigen.

.....In this research, CaFeO_3 (CF), $\text{CaFe}_{0.8}\text{Mg}_{0.2}\text{O}_3$ (CFM-82), $\text{CaFe}_{0.8}\text{Mg}_{0.1}\text{Zn}_{0.1}\text{O}_3$ (CFMZ-811), and $\text{CaFe}_{0.8}\text{Zn}_{0.2}\text{O}_3$ (CFZ-82) perovskite oxide materials was synthesized using solid state reaction and prepared as dense ceramic membranes using dry-pressing method. Fe_2O_3 used as a precursor was obtained from mill scale waste treatment and the purity of every precursor was evaluated using XRF. Oxygen desorption properties of the perovskite oxide powders was evaluated using O_2 -TPD with oxygen adsorption capacity decreasing in the order of CFM-82 > CFMZ-811 > CFZ-81 > CF. Estimation of oxygen vacancies was conducted from O_2 -TPD data. Stoichiometric confirmation and crystal structure of perovskite oxide powders was evaluated using XRF and XRD analysis. Rietveld refinement was performed by using High Score PlusTM. Density and porosity of perovskite membranes was evaluated by using Archimedes Method. Structural strength of perovskite membranes was evaluated by using Vickers Hardness Test with the decreasing of Vickers Hardness value in the order of CFM-82 > CFZ-81 > CF > CFMZ-811. Study on oxygen desorption properties of CF, CFM-82, CFMZ-811, and CFZ-82 was conducted to evaluate the potential of each membranes to be used as oxygen transport membrane materials.