Konversi gas karbon dioksida dan metana dalam reaktor plasma non-termal dengan konfigurasi umpan 3-Lewatan = Conversion of carbon dioxide and methane in the three pass flow configuration of non thermal plasma reactor

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Abstrak

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Sebagai salah satu gas rumah kaca, gas CO2 dan CH4 akan dikonversikan menjadi gas yang berguna dalam reaktor plasma non-termal dengan konfigurasi umpan 3-lewatan, yang beroperasi pada suhu ruangan. Reaktor mempunyai keunggulan dapat sekaligus mendinginkan elektroda tegangan tinggi pada proses reaksinya dan memanaskan awal umpan sebelum masuk zona plasma.
Laju alir gas CO2 yang digunakan adalah 500-1.500 mL/menit dengan Time on Stream (TOS) 2,1-8,4 menit, sedangkan pada reformasi gas CO2 digunakan campuran gas CO2/CH4 (1/1) dengan laju alir 9,19; 19,45 dan 85,43 mL/menit dengan TOS 140 menit, dan tegangan reaktor 12,27 kV. Dekomposisi gas CO2 menghasilkan gas CO dan O2 dengan konversi rendah dan menurun kembali setelah TOS 2,1 menit, karena adanya reaksi berbalik.
Dari reformasi gas CO2 dihasilkan gas sintesis, H2 dan CO, C2H6 serta komponen C3. Konversi CO2 dan CH4 tertinggi dicapai pada laju alir 9,19 mL/menit yaitu 36,73% dan 35,52%. Energi spesifik terbaik pada dekomposisi CO2 adalah 270 kJ/mol, sedangkan pada reformasi CO2 adalah 2.333,5 kJ/mol. Analisis PSSH dapat memprediksi suhu lokal pada beberapa titik didalam reaktor, sebesar ratarata 1425 K. Penelitian ini perlu dikembangkan sampai skala komersial dengan konversi dan efisiensi tinggi, untuk digunakan juga pada gas alam dengan kandungan CO2 tinggi, menghasilkan gas sintesis dan juga hidrokarbon rantai panjang sebagai bahan bakar cair melalui proses Fischer Tropsch.
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As one of the Greenhouse gas, CO2 and CH4 will be converted into valuable gas in the three-pass flow configuration of non-thermal plasma reactor that operated in the room temperature. Reactor has advantage can simultaneously cool the high voltage electrode during reaction process and preheat the feed before entering the plasma zone.
The used of CO2 feed flow rates was 500-1,500 mL/minute with Time on Stream (TOS) between 2.1-8.4 minutes, and CO2 reforming used the mixture of CO2/CH4 (1/1) with the feed flow rates of 9.19, 19.45 and 85.43 mL/minute until TOS 140 minutes. The electrical voltage was 12.27 kV. The CO2 decomposition produced CO and O2 with low conversion and dropped off after TOS 2.1 minutes, due to the

occurrence of reverse reaction.
The CO2 reforming process produced synthesis gas, C2H6 and C3 components.
The highest CO2 and CH4 conversion reached 36.73% and 35.52%, respectively at the feed flow rate of 9.19 mL/minute. The best specific energy in the CO2 decomposition was 270 kJ/mol, while the CO2 reforming was 2,333.5 kJ/mol. Analysis of PSSH identified the local spots temperature inside the reactor, by an average of 1425 K. This research need to be developed into a high performance and efficient commercial scale reactor, to be used also for high CO2 content natural gas, producing synthesis gas and also high chained of liquid fuel hydrocarbon through Fischer Tropsch processes, As one of the Greenhouse gas, CO2 and CH4 will be converted into valuable gas
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