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1D modeling of multichannel membrane reactor for the production of pure Hydrogen

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Hydrogen as a carbon-less energy carrier is playing an important role in meeting energy demands. It has extensive applications in laptops, hydrogen vehicles, electricity production and space shuttle fuels production. Hydrogen production is viable through non-renewable resources including fossil fuels and electrochemical methods and renewable resources. One of the most important hydrogen production processes is steam methane reforming (SMR) by which hydrogen is separated from syngas along with carbon monoxide and carbon dioxide. Membrane reactors are integrated systems of reaction and separation and are used specifically to increase the rate of reaction, selectivity applications and their pure production. Multichannel membrane reactor (MCMR) is developed to utilize the systems with decentralized hydrogen production through steam methane reforming. In these reactors, the channel in which methane catalytic combustion (MCC) would take place is adjacent to the channel is which SMR that is very endothermic is taking place so it would produce the heat which is needed for the reaction. Pd-Ag membrane in reforming channel would change the balance of the reaction and results in pure hydrogen production in a single vessel. In this research, 1D modeling of multichannel membrane reactor to separate Hydrogen from Syngas through SMR is been studied. Results show that the conversion percentage of methane in SMR channel is 81%, while it is in 90% in combustion channel. Also, hydrogen with 99.99% purity is accessible through Pd-Ag membrane.

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