Hydrogen Production By Steam Reforming of Product Gas Produced By Biomass Gasification

Parham Sadooghi[1], Reinhard Rauch[1]

[1]Vienna University of Technology, Vienna, Austria

Abstract

Climate change and global warning are the most important challenges facing the world today therefore research and developments have focused on the use of biomass as an alternative to fossil fuels. The widespread availability of biomass has been widely recognized, as has its potential to supply much larger amounts of useful energy with fewer environmental impacts than fossil fuels. Biomass can be converted into commercial products via either biological or thermochemical processes [1-3].Gasification is a well established technique to convert biomass fuels into liquid and gaseous products. The gaseous products are mainly hydrogen, carbon monoxide, carbon dioxide, methane, and other low-molecular hydrocarbons.Steam reforming of hydrocarbons produced by biomass gasification is an important process to produce hydrogen and/or synthesis gas which are most important building blocks in chemical and refinery industry for ammonia production or as feedstock to the Fischer-Tropsch process for liquid hydrocarbons production . Methane is a very stable molecule and steam reforming takes place in packed bed reactors where methane reacts with excessive steam at high temperature over a Ni based containing catalyst, because a reasonable conversion of methane is required in this process.Catalytic fixed-bed reactors are the most important type of reactors which are used in synthesis and steam reforming technologies .Due to the strongly endothermic nature of the methane steam reforming process, a large amount of heat is supplied by means of electrical heating which keep the outer surface of the reactor at certain temperature, therefore reformer tube wall and the catalyst tubes are exposed to significant axial and radial temperature gradients. In developing of these kind of reactors the knowledge of the temperature profiles and gas compositions within the reactor play an important role and are important for designing and optimizing the catalysts structure and the reactor geometry to achieve the best performance. Different methods have been used to model methane steam reforming in fixed bed reactors,[4-6]. This paper reports investigations of steam methane reforming process by means of mathematical modeling. A packed bed reactor filled with nickel catalyst is simulated numerically by state of the art Finite Element Method software (COMSOL Multiphysics). The steady state pseudo-heterogeneous model represents the heat and mass transfer in the reactor tube. Effect of different reactor temperature on methane and carbon dioxide conversion as well as hydrogen yield and carbon selectivity are investigated.The obtained results are satisfactory when compared to the literature, giving similar profiles but slightly different temperature values and concentration profiles.

Reference

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