Methane Reforming with Co_2 Using Molybdenum Carbide (Mo_2C and Mo_2C/Al_2O_3) as Catalysts

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Abstract

Several studies have been made in order to find other processes to convert natural gas onto syngas. Reforming process using CO_2 have shown to be attractive process due its advantages when compared to reforming process with vapor. CO_2 reforming present high operational and invest costs, and syngas is produced with lower ratio of H_2/CO. This reforming is more advantage to Fischer Tropsh Reactions and other industrial processes, as Hydroformlation and acetic acid synthesis. Dry reforming also CO_2 and CH_4 emissions to the atmosphere.
Dry reforming contributes also to control the environmental pollution reducing CO_2 and CH_4 emissions. Concerning to catalysts, molybdenum carbide has exhibit important catalytic activity and selectivity when used on the petroleum refining industry and for natural gas treatment. This carbide presents also excellent thermal stability and resistance to poisoning.
In this research work, reforming with CO_2 was studied using Mo_2C and Mo_2C/Al_2O_3 as catalysts synthesized from ammonium heptamolybdate. The main parameters as temperature, rate of heating, methane-hydrogen mixture concentration during the co-reduction-carburization reactions were optimized. The catalytic tests were carried out in quartz bed reactor and gaseous products as well methane concentration were analyzed by gas chromatography.

Transport Phenomena of a Spray Drying Used for the Obtaining of the Powder of Niobate Oxalate of Ammonia ($(NH_4)_3[NbO(C_2O_4)_3]_3H_2O$)

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Abstract

Powders of the oxalate niobate of ammonia ($(NH_4)_3[NbO(C_2O_4)_3]_3H_2O$) has been used as precursory in the synthesis of niobium carbide (NbC) under temperatures lower than the industrial process (950^oC) by means of a reaction between methane (CH_4) and hydrogen (H_2). The niobium carbide can be used in hard metal alloys, catalysts among other applications, but, for this, is necessary particle homogeneity and high surface area from the carbide, coming from its precursory. Nowadays, the drying through atomization of solutions (spray drying) is a solution for the obtaining of the precursory powder with these specific properties. However, the optimization of the process, most of the time, is realized in an empirical way and it implies a reasonable cost and also the time spent with experimental tests, because many times, all the transport phenomena involved in the process is unknown. The modeling and simulation of such drying process take place as an auxiliary tool for the knowledge of the spray drying transport phenomena. This work presents the mathematical modeling of a spray drying used for the obtaining of the powder of niobate oxalate of ammonia, as the modeling of the heat transfer and the weight of the process.