

The effect of potassium promoter on the activity of wustite-based ammonia synthesis catalyst

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Ammonia synthesis reaction from N_2 and H_2 is composed of several steps. The main role of ammonia synthesis catalyst is to dissociate the N_2 bond, because of its high bond energy. It is the heart of the ammonia plant and has a direct effect on the economic benefits of the whole plant, and is thus called an economic catalyst[1]. Wustite-based ammonia synthesis catalyst (WASC) is the new generation ammonia synthesis catalyst that is more highly active than magnetite-based catalyst[2]. It was typically produced by a high-temperature fusion method in which a high-grade magnetite and iron/graphite and promoters are melted followed by cooling, crushing, and sieving. An electrical furnace will be used for melting material above 1800 °C. The usual promoters such as Al, Ca, K, Mg, and Si were used for improving activity, heat resistance, and antitoxic performances[3]. The most important promoter that is effective in the activity (NH_3 %) of wustite catalyst is potassium (K) which is named an electronic promoter. It is donated an electron to the anti-bonding N_2 bond that is facilitated the dissociation of N_2 in the rate-determining step. In this research, some samples of WASC were prepared with various content of K (0.5-2 %), and their activity of them was measured. It was shown that about 1 % K is enough for activity. It was concluded that the high amount of K promoter does not result in high activity.

Keywords: wustite, ammonia synthesis, potassium, promoter

References

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