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عنوان مقاله:

Application of Dusty Gas Model to Study non- Isothermal Effects in Methanol Synthesis

محل انتشار:

دهمین کنگره ملی مهندسی شیمی ایران (سال: 1384)

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خلاصه مقاله:

The dusty gas model is used to establish the effect of temperature and pressure gradients on catalyst pellet effectiveness factors for the methanol synthesis reaction. A comparison is presented between the isothermal and non-isothermal model prediction of effectiveness factor. The cases studied cover the operational range of temperature, pressure and composition for the commercial methanol synthesis reactors. The results do not show any meaningful deviation for the industrial size catalyst, thus the isothermal model can be used safely for modeling intra-particle diffusion limitations in the industrial reactor. Furthermore, the role of bulk diffusion and thermo-diffusion in setting up the concentration gradient is studied. Both of the phenomena show negligible contribution to the overall molar flux. Pressure gradient, however, should not be neglected even though it may not contribute directly to the total flux. Assumption of an isobaric pellet can lead to contradiction with conservation of mass. To assess the validity of Fick's equation approximation to the dusty gas model, the results of the dusty gas model and Fick's equation are compared and the shortcomings of Fick's approximation in explaining multi-component diffusion is studied. Effectiveness factors obtained from Fick's equation with an effective diffusion coefficient does not show much deviation from the rigorous dusty gas model, however when tilized to study the phenomena inside a catalyst pellet, it is shown that it can be misleading in some cases.

کلمات کلیدی:

Intra-particle diffusion, Methanol synthesis, Effectiveness Factor

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