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论文

低浓度煤层气吸附过程的模拟

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摘要：

采用Aspen Adsorption软件对CH4 和N2 分别为30%和70%低浓度煤层气的吸附过程进行模拟，得到吸附柱出口CH4 和N2 浓度随时间的变化关系和吸附柱轴向负载分布，考察压力、温度和传质系数对甲烷吸附过程和穿透曲线的影响。研究结果表明：对甲烷出口浓度的模拟值与实验值基本吻合，甲烷在吸附时间3 000 s时达到饱和，吸附量为6.75×10 -4 kmol/kg，约为氮气吸附量的2倍；甲烷穿透曲线随压力的增大后移，从100~500 kPa的穿透时间从392 s延至2 187 s。温度在273~323 K甲烷的穿透曲线基本不变；传质系数远小于1.000 s -1 时对吸附性能影响较大，传质系数为0.001 s -1 时的穿透时间约为0.010 s -1 时的两倍，但其大于1.000 s -1 后对穿透曲线几乎没有影响。

关键词： 低浓度煤层气 甲烷吸附 Aspen Adsorption软件 穿透曲线

Simulation of adsorption process of low concentration coal bed methane

Abstract:

The adsorption process，supported by Aspen Adsorption software，was simulated for low concentration coalbed methane (CBM) composed of 30% CH4 and 70% N2 ，and the effects of operating pressure，temperature and the mass transfer coefficient on the outlet methane concentration were studied.Moreover，the variations of the concentrations of methane/nitrogen with adsorption time，and the axial distributions of methane/nitrogen adsorption quantity along the adsorption column were obtained.The results show that the simulation values of methane concentration are basically consistent with the results of experiment.The methane is saturated when adsorption time is 3 000 s，with the adsorption quantity of 6.75×10 -4 kmol/kg，which is about 2 times larger than that of nitrogen.In addition，the breakthrough curves of methane shifts to the longer time from 392 s to 2 187 s，with the pressure increasing from 100 kPa to 500 kPa，and the effect of temperature on the breakthrough curve is negligible within the range of 273-323 K.Furthermore，the methane adsorption quantity changes evidently when the value of mass transfer coefficient is smaller than 1.000 s -1 ，and the breakthrough time at the value of mass transfer coefficient 0.001 s -1 is about two times when the mass transfer coefficient is 0.010 s -1 ，but there is almost no effect on the breakthrough curve when the mass transfer coefficient is greater than 1.000 s -1 .

Keywords: low concentration coalbed methane；methane adsorption；Aspen Adsorption software；breakthrough curve

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