高等学校化学学报 2006 , 27 (10): 1912-1917 ISSN: 0251-0790 CN: 22-1131/O6

研究论文

甲醛在*α*-Al_2O_3颗粒物表面的非均相反应研究

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收稿日期 2005-12-6 修回日期 网络版发布日期 2006-10-8 接受日期

摘要 使用漫反射傅里叶变换红外光谱(DRIFTS)原位反应器研究了273~333 K下甲醛与*α*-Al_2O_3颗粒物表面的非均相反应. 结果表明, 甲醛在*α*-Al_2O_3颗粒物表面生成产物主要为甲酸盐、二氧亚甲基以及少量多聚甲醛和吸附态甲醛, 甲酸盐是由中间产物二氧亚甲基进一步氧化生成的. 在293 K下, 甲醛在*α*-Al_2O_3颗粒物表面的反应级数为0.81±0.05, 以样品池几何面积计算的初始摄取系数γ_{0GEO}为$(2.3\pm0.5)\times10^{-5}$, 以颗粒物BET面积计算的初始摄取系数γ_{0BET}为$(9.4\pm1.7)\times10^{-9}$, 表观活化能为33.5 kJ/mol.

关键词 甲醛 α-Al_2O_3 漫反射傅里叶变换红外光谱(DRIFTS) 非均相反应

分类号 0643.1

Heterogeneous Reaction of Formaldehyde on Surface of *α*-Al_2O_3 Particles

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Abstract Formaldehyde is one of the most important carbonyl organic compounds. Heterogeneous reactions of formaldehyde on the surfaceof oxides of crustal elements could be an import sink for formaldehyde in atmosphere. In this study, the kinetics of the heterogeneous reaction of formaldehyde on the surface of *α*-Al_2O_3 were *in situ* investigated by diffuse reflectance infrared Fourier transform spectroscopy(DRIFTS) over the temperature range of 273—333 K. The adsorbed species, formate(Ⅰ), dioxymehtylene(Ⅱ), polyoxymethylene(Ⅲ) and formaldyhyde(Ⅳ), on *α*-Al_2O_3 particles were identified with infrared spectrum: on the surface of *α*-Al_2O_3 particles, formaldyhyde was oxidized at first to dioxymehtylene which was further oxidized to formate. The reaction order was determined as 0.81±0.05, and the initial reactive uptake coefficients at 293 K were calculated with the geometric and the BET specific surface areas are$(2.3\pm0.5)\times10^{-5}$ and $(9.4\pm1.7)\times10^{-9}$, respectively. The apparent activation energy of the reaction was etermined as 33.5 kJ/mol.

Key words Formaldyhyde α-Al_2O_3 DRIFT S Heterogeneous reaction

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