

REACTION KINETICS, CATALYSIS AND.....

[bmim]Cl / FeCl₃离子液体催化苯与乙烯烷基化反应的新型机理

孙学文, 赵锁奇, 王仁安

State Key Laboratory of Heavy Oil Processing, Petroleum University (Beijing), Beijing 102249, China

收稿日期 修回日期 网络版发布日期 接受日期

摘要 Up to now the mechanism of Friedel-Crafts reactions catalyzed by ionic liquid have not been fully understood, while carbocation mechanism was assumed. It was found that the source of H⁺ and the route of reaction initiated the alkylation of benzene with ethylene catalyzed by [bmim]Cl/FeCl₃ ionic liquid. The fact that dehydrated ionic liquids have catalytic activity for the alkylation of benzene with ethylene suggests that there exists a new catalytic route. The distinctly Bronsted acid properties of 2-H in [bmim]Cl were found through FT-IR and HNMR analysis of [bmim]Cl after titration with water free KOH in alcohol solution. In addition, the chemical shifts of proton on the [bmim]Cl ring, especially 2-H, are sensitive to the change of FeCl₃ content and shifted downfield when FeCl₃ was added into [bmim]Cl to form ionic liquid. Thus 2-H was easy to be disengaged from imidazolium ring with formation of H⁺ to initiate the reaction. The isotope-substituted method was employed to prove this mechanism, through the GC-MS analysis of alkylation products of deuterated benzene with ethylene. The route of alkylation catalyzed by FeCl₃ ionic liquid was found to follow the carbocation mechanism, the resource of H⁺ was presented and proved using HNMR analysis of ionic liquid to inspect the intensity change of 2-H. It was found that the intensity of 2-H reduced 23% after reaction showing that the H⁺ arising from alkylation reaction was supplied by 2-H on the imidazole ring.

关键词 [bmim]Cl / FeCl₃, 苯, 乙烯, 烷基化反应, 离子性液体

分类号

DOI:

New Alkylation Route of Benzene with Ethylene Catalyzed by [bmim]Cl/FeCl₃ Ionic Liquid

SUN Xuewen, ZHAO Suoqi, WANG Ren'an

State Key Laboratory of Heavy Oil Processing, Petroleum University (Beijing), Beijing 102249, China

Received Revised Online Accepted

Abstract Up to now the mechanism of Friedel-Crafts reactions catalyzed by ionic liquid have not been fully understood, while carbocation mechanism was assumed. It was found that the source of H⁺ and the route of reaction initiated the alkylation of benzene with ethylene catalyzed by [bmim]Cl/FeCl₃ ionic liquid. The fact that dehydrated ionic liquids have catalytic activity for the alkylation of benzene with ethylene suggests that there exists a new catalytic route. The distinctly Bronsted acid properties of 2-H in [bmim]Cl were found through FT-IR and HNMR analysis of [bmim]Cl after titration with water free KOH in alcohol solution. In addition, the chemical shifts of proton on the [bmim]Cl ring, especially 2-H, are sensitive to the change of FeCl₃ content and shifted downfield when FeCl₃ was added into [bmim]Cl to form ionic liquid. Thus 2-H was easy to be disengaged from imidazolium ring with formation of H⁺ to initiate the reaction. The isotope-substituted method was employed to prove this mechanism, through the GC-MS analysis of alkylation products of deuterated benzene with ethylene. The route of alkylation catalyzed by FeCl₃ ionic liquid was found to follow the carbocation mechanism, the resource of H⁺ was presented and proved using HNMR analysis of ionic liquid to inspect the intensity change of 2-H. It was found that the intensity of 2-H reduced 23% after reaction showing that the H⁺ arising from alkylation reaction was supplied by 2-H on the imidazole ring.

Key words alkylation; mechanism; ethylene; benzene; [bmim]Cl/FeCl₃ ionic liquid

通讯作者:

孙学文 sunxwb2000@163.com

作者个人主页: 孙学文; 赵锁奇; 王仁安

扩展功能

本文信息

[Supporting Info](#)

[PDF\(1388KB\)](#)

[HTML全文\(OKB\)](#)

[参考文献](#)

[服务与反馈](#)

[把本文推荐给朋友](#)

[加入我的书架](#)

[加入引用管理](#)

[引用本文](#)

[Email Alert](#)

[文章反馈](#)

[浏览反馈信息](#)

相关信息

[本刊中 包含 "\[bmim\]Cl / FeCl₃" 的相关文章](#)

本文作者相关文章

[孙学文](#)

[赵锁奇](#)

[王仁安](#)