

基于胺-醇烷基化制备取代胺类化合物的清洁催化体系研究

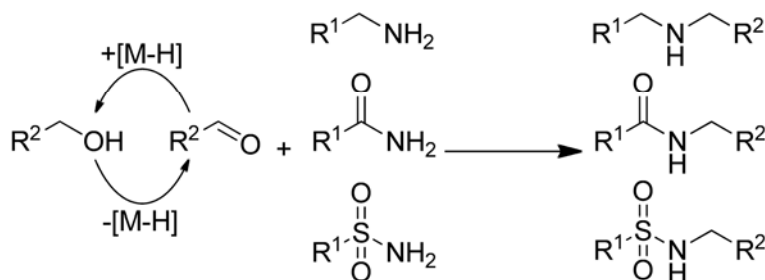
石峰*, 崔新江, 张妍, 袁航空, 邓友全

中国科学院兰州化学物理研究所, 绿色化学与催化中心, 兰州, 730000

Email: fshi@licp.cas.cn

关键词: 胺, 醇, 烷基化, 催化, 清洁

烷基化胺类化合物是一类重要的化工中间体, 广泛应用于医药, 农药及染料等的合成。胺类化合物通常由胺与卤代烃反应制得。这种方法需要消耗化学计量的碱性助剂, 产生大量无机废渣, 造成严重的环境污染。醇替代卤代烃作为反应原料, 水是唯一副产物, 能够减少污染物的生成。传统上胺与醇反应制备取代胺类化合物主要使用贵金属钌和铱等均相催化体系。高效非贵金属体系和负载纳米贵金属催化剂体系的研究对于开发廉价且环境友好的取代胺类化合物制备方法具有非常重要的意义。近年来, 我们对 $\text{Cu}(\text{OAc})_2$, FeCl_2 等非贵金属催化体系、 RuCl_3 催化体系以及 Ag-Mo , $\text{Pd/Fe}_2\text{O}_3$, $\text{Au/Fe}_2\text{O}_3$ 等多相催化体系的制备及其催化取代胺类化合物的清洁合成进行了系统的研究, 针对磺酰胺、碳酰胺、胺类和硝基类化合物与醇反应一步烷基化发展出了多个清洁、高效的催化体系¹⁻⁴, 式一。



式一、胺-醇烷基化制备取代胺类化合物

1. X. Cui, Y. Zhang, F. Shi* and Y. Deng, *Chem. Eur. J.*, **2011**, 17, 1021-1028.
2. X. Cui, Y. Zhang, F. Shi* and Y. Deng, *Chem. Eur. J.*, **2011**, 17, 2587-2591.
3. Q. Peng, Y. Zhang, F. Shi* and Y. Deng, *Chem. Commun.*, **2011**, 6476-6478.
4. Yan Zhang, Xiujuan Qi, Xinjiang Cui, Feng Shi* and Youquan Deng, *Tetrahedron Lett.*, **2011**, 52, 1334-1338.
5. Y. Zhang, X. Cui, Feng Shi* and Y. Deng, *Chem. Rev.*, **2012**, doi: cr200260m.

Clean and economic synthesis of N-alkyl amines through alcohol amination

Feng Shi*, Xinjiang Cui, Yan Zhang, Hanghong Yuan and Youquan Deng

Centre for Green Chemistry and Catalysis, Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences, Lanzhou, 730000, China

N-alkyl amines are important intermediates in chemical industry. The clean and economic synthesis of N-alkyl amines have attracted extensive attentions and rapid progress has been achieved in the last decades. However, homogeneous catalysts, i.e. noble metal complex and organic ligand, were normally employed, which makes the system complicated and unpractical. The utilization of non-noble metal and heterogeneous catalysts could be a good choice to develop clean and economic alcohol amination reactions. Recently, several non-noble metal and heterogeneous catalysts such as $\text{Cu}(\text{OAc})_2$, FeCl_2 , Ag-Mo , $\text{Pd/Fe}_2\text{O}_3$ and $\text{Au/Fe}_2\text{O}_3$ have been explored in our group. The catalytic amination of alcohols with different structures could be performed with good to excellent results. Moreover, the one-pot synthesis of N-alkyl amines from nitrobenzene/nitrile compounds and alcohols were also realized using ruthenium or supported nano-gold catalysts with good activity and selectivity.