

论文

温室气体CO₂资源化催化转化研究进展

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摘要:

随着全球化低碳经济时代的开启, 温室气体的减排及利用成为举世关注的焦点, 二氧化碳资源化利用及由此形成的新的碳一化学将成为绿色催化研究领域的热点问题。本文综述了二氧化碳资源化催化转化为高附加值化学品的若干反应途径, 包括二氧化碳氧化饱和烃类、二氧化碳合成有机酸、二氧化碳合成酯类等, 全面比较了实现这些反应所用催化剂的催化特性及优缺点, 对其中的重要催化机理作了详细阐述, 提出了该领域今后亟待开展的主要研究方向, 认为: CO₂的定向活化是其资源化利用的关键, 需要研发与之相关的具有高活性的催化剂; 新的反应介质或新相态CO₂反应体系的利用, 对大幅度提高CO₂的转化率和目标产物的选择性将更具开发潜力; 针对多种污染源排放CO₂气体的直接利用问题, 有必要设计开发对CO₂具有高吸附-催化活性的多效催化剂, 以提高新技术的实用价值; 此外, 积极探索CO₂的光催化转化以及对光合作用特性的模拟, 对于新能源利用和温室气体减排将具有双重收益。

关键词: 温室气体; 二氧化碳; 催化转化; 活化

Current status on catalytic conversion of greenhouse gas CO₂ to value added chemicals

Abstract:

With the global low carbon economy era commences, the reduction and utilization of greenhouse gas becomes a major concern in the world. The reclamation of greenhouse gas CO₂ and the new opportunity it brings in the research area of carbon chemistry will become a new hot spot in the research frontier of green catalysis. In this paper, various typical catalytic reaction pathways for enabling direct conversion of CO₂ to useful value added chemicals were reviewed, including oxidation of saturated hydrocarbon by CO₂, synthesis of organic acids and esters with CO₂. Furthermore, some comments were made regarding the advantages and disadvantages of the catalysts involved, and their underlying reaction mechanisms of CO₂ activation by catalysis. Based on these discussions, future work in this category was proposed. The authors believe that, the task oriented activation of CO₂ is the key factor governing the whole process of its chemical utilization, where suitable catalysts with high activity need to be developed; the exploitation of new reaction media and use of new phase state CO₂ may greatly enhance the conversion and selectivity of the reaction and hence deserve further investigation; as to the direct use of CO₂ emitted from different practical sources, it is quite necessary to develop multi functional catalysts with desirable adsorption catalysis activity, so as to meet the requirements from different cases; in addition, the investigation of photocatalysis of CO₂, and the characterization and simulation on the process of photosynthesis are beneficial to both the utilization of new energy and the mitigation of greenhouse gas.

Keywords: greenhouse gas; carbon dioxide; catalytic conversion; activation

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