

8th International Conference on **Environmental Chemistry and Engineering**
&
7th Edition of International Conference on
Green Energy, Green Engineering and Technology

September 20-22, 2018 Berlin, Germany

A green PVC dream is coming true in China: Heterogeneous non-mercury catalysts and related process for acetylene hydrochlorination

Guohua Luo

Tsinghua University, China

Acetylene hydrochlorination to produce VCM (vinyl chloride monomer) is the core reaction for PVC production from coal resource, and this process was taking about 80% market share in 2016 in mainland China. On the other hand, traditional activated carbon based mercury catalyst are widely used commercially and causes severe environmental pollution and social impact day and night. In recent years, R&D on non-Hg catalyst has drawn increasing attention in China from both academic and industrial fields and even policy-makers. In the last half-century, scientists worldwide have proved that many kinds of metals can be active for this reaction, and among them gold is widely considered as the most active metal for replacing Hg. Smart non-Hg catalyst with both high activity and long lifetime, and related new process with simple design and low operation cost, will show the best potential for future industrial application. In the last ten years, we have proved that the reaction stability of Au-Cu@carbon catalyst can be dramatically enhanced by the introduction of organic ion ligands. Several ligands were selected and trichloroisocyanuric acid (TCCA) was proved to be the best organic ion ligand for preventing Au³⁺ from reduction by acetylene, leading to over 18000 hours industrial plant-trial evaluation record, and the VCM productivity reached 4.2 times comparing to industrial mercury catalyst. Meanwhile, DFT calculation results also show that the stability of catalyst is strongly related to the adsorption energy of reactants on the surface of catalysts. Finally, our previous fluidized beds process using Bi-Cu@SiO₂ catalyst will also be discussed in this talk. The dream for green PVC is coming soon in China.

Recent Publications

1. Hao Xu, Kai Zhou, Jiangkun Si, Chunhua Li and Guohua Luo (2016) Ligand coordination approach for high reaction stability of an Au-Cu bimetallic carbon-based catalyst in acetylene hydrochlorination process. *Catalysis Science & Technology* 6:1357-1366.
2. Kai Zhou, Jinchao Jia, Chunhua Li, Hao Xu, Jun Zhou, Guohua Luo and Fei Wei (2015) A low content Au-based catalyst for hydrochlorination of C₂H₂ and its industrial scale-up for future PVC processes. *Green Chemistry* 17(1):356-364.
3. Kai Zhou, Wei Wang, Zhun Zhao, Guohua Luo, Jeffrey T Miller, Michael S Wong and Fei Wei (2014) Synergistic gold bismuth catalysis for non-mercury hydrochlorination of acetylene to vinyl chloride monomer. *ACS Catalysis* 4(9):3112-3116.
4. Kai Zhou, Jiangkun Si, Jinchao Jia, Jiaqi Huang, Jun Zhou, Guohua Luo and Fei Wei (2014) Reactivity enhancement of N-CNTs in green catalysis of C₂H₂ hydrochlorination by a Cu catalyst. *RSC Advances* 4(15):7766-7769.
5. Kai Zhou, Jinchao Jia, Xiaogang Li, Xiaodong Pang, Chunhua Li, Jun Zhou, Guohua Luo and Fei Wei (2013) Continuous vinyl chloride monomer production by acetylene hydrochlorination on Hg-free bismuth catalyst: From lab-scale catalyst characterization, catalytic evaluation to a pilot-scale trial by circulating regeneration in coupled fluidized beds. *Fuel Processing Technology* 108(SI):12-18.

Biography

Guohua Luo is an Associate Professor in the Department of Chemical Engineering, Tsinghua University. His research interest covers from fundamental level by lab-scale experiments to potential industrial applications on novel solid catalysts design and evaluation, gas-solid fluidized-bed reactors for carbon nanotubes, DeNO_x process, catalytic synthesis of fine chemicals and green nano-gold@carbon (non-Hg) catalyst for PVC industry. He has published over 90 peer-reviewed academic papers which have been cited over 2000 times. He received three first prizes, from the Ministry of Education of China in natural science (2005) and technology invention (2012), from Chinese Union of Petroleum and Chemical Industry in science and technology progress (2015).

luoguoh@tsinghua.edu.cn