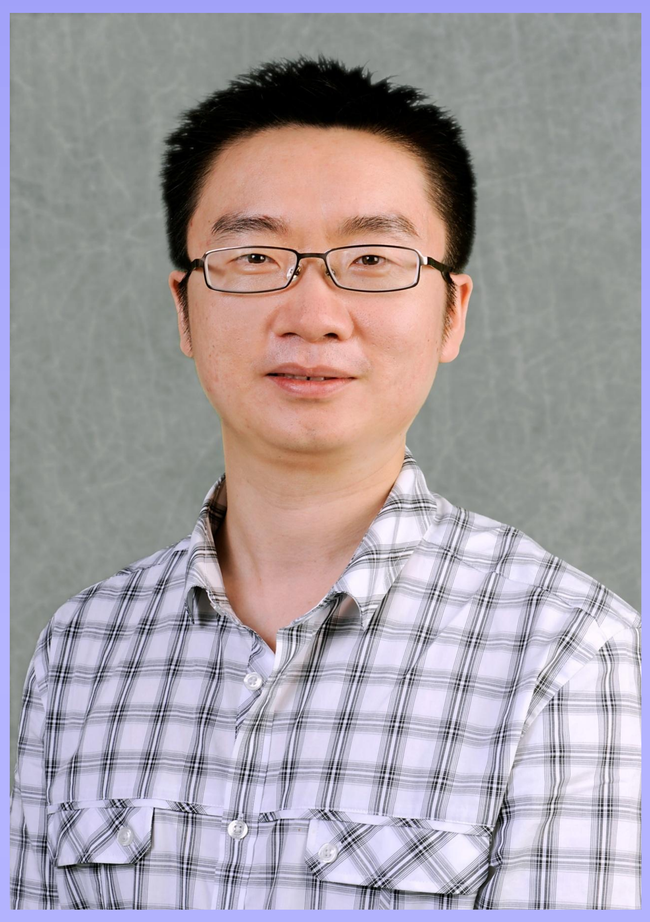
过程工程研究所青促会“青年沙龙”
特邀学术报告



演讲嘉宾：Prof. Fanxing Li（美国 北卡罗莱纳州立大学）

演讲题目：Tailored Transition Metal Oxide Particles for Sustainable Energy Conversion

演讲主持：李松庚 研究员

演讲时间：2015年8月12号 (周三) 14:20

演讲地点：中科院过程大厦308会议室

主　　办：中科院过程工程所青促会

嘉宾简介：

Dr. Fanxing Li is an Assistant Professor in the Chemical and Biomolecular Engineering Department at North Carolina State University. Dr. Li received his BS and MS degrees in chemical engineering from Tsinghua University in 2001 and 2004, respectively. He received his PhD at the Ohio State University in 2009 under the direction of Prof. Liang-Shih Fan. Dr. Li has published 38 journal articles and book chapters. He is also an inventor/co-inventor of 11 patents and patent applications. He has won numerous awards including the Best PhD in Particle Technology Award, the U.S. National Science Foundation CAREER Award, SABIC Young Professional Award and NC State Sigma Xi Faculty Research Award.

报告摘要：

As an alternative approach for carbonaceous fuel conversion and CO_2 capture, the so-called chemical looping strategy utilizes redox properties of first-row transition metal oxides to simplify the conventional energy conversion processes. In a typical chemical looping process, carbonaceous feedstock is oxidized into products such as CO_2 by active lattice oxygen (O^{2-}) in the transition metal oxide particles, a.k.a. oxygen carrier. In a subsequent step, the O^{2-}-deprived oxygen carrier particles are replenished by a gaseous oxidant, generating hydrogen or heat. The cyclic redox operation, often carried out in circulating fluidized bed reactors, has the potential to significantly reduce the energy loss for carbonaceous energy conversion and carbon dioxide capture.

While a number of supported metal oxides have demonstrated promising redox performances, further improvements of the activity and redox stability of these oxygen carriers are of critical importance for successful deployment of this novel technology. To date, oxygen carrier development largely relies on a trial-and-error type of approach. Using iron-containing oxides as an example, we present a rationalized strategy for oxygen carrier optimization: to arrive at oxygen carriers with superior activity, the rate limiting step for the redox reactions is first identified. Mixed ionic-electronic conductive support that de-bottlenecks such a rate limiting step is then used to improve the metal oxide activity by two orders of magnitude. Investigation of oxygen carrier deactivation mechanisms further sheds light for designing oxygen carriers with both high activity and extended lifetime. Besides their applications in chemical looping combustion, transition metal oxides with tailored nano-structures for methane partial oxidation, solar-based water-splitting, and oxidative dehydrogenation are also exemplified.

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