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High performance oxygen carriers for chemical looping combustion process by using architectural structure of silica nanoparticles

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Chemical looping combustion (CLC) represents a very promising approach to reduce CO_2 emissions in the fossil fuel powered energy generations. Oxygen carriers, composed of active metal oxides, play important roles in CLC process by transferring oxygen between oxidation and reduction reactors. To assure its mechanical strength and long-term activity, a porous support material is necessary. Recently, we have focused our research on generating hierarchical porous granulate support via controlled synthetic approaches, to develop advanced oxygen carrier: high pore volume and specific surface area, mechanical resistance to attrition in the fluidized bed reactors and long service life time.

To form hierarchical silica porous support for oxygen carriers, assembly of silica nanoparticles, including both the self-assembly and template directed assembly methods, is applied in this work. The well assembled silica nanoparticles together with the selected templating agents (or other additives) are processed into macroscopic granulates with size above 200μm, via a top down approach, which involves vacuum filtration, pressing and grinding processes. After removing the contained templates and free the pores in the macroscopic units, precursors of active metal oxides (such as CuO) are impregnated into the developed porous supporting material and their performance on CLC process is investigated. In this talk, the effect of microstructure of the inert support, interaction between substrate and active metal oxides, as well as the loading amount of metal oxides will be discussed. Additionally, the performance of developed oxygen carrier materials on CLC process will be also compared with porous diatomite based oxygen carriers.

Biography

Yujing Liu finished her Master degree in Materials Science and Engineering in 2008, at Tsinghua University in China. Afterwards, with the support of DAAD/Siemens Postgraduate scholarship, she went to Germany to continue her PhD study at Ludiwig-Maximilians Universitaet Muenchen (LMU Munich, Germany) and completed in 2012, on the research topic of 'Nanostructured transparent conducting oxide electrodes through nanoparticle assembly'. Currently, she is a holder of Marie-Curie action COFUND fellowship and Postdoc Research Scientist at the Department of High Performance Ceramics, EMPA, Switzerland. Her research interests are focused on processing of nanostructured porous materials into various industrial applications.

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