|  |
| --- |
| **Technologies and Equipment for Chemical Process Intensification**  |
| Contact perso:WANG Jingdai | Email:wangjd@zju.edu.cn |
| **Research background:** Chemical industry is always one of dominant factors thatsignificantly affects the progress of national economy and social development. So far, the output value of chemical industry has accounted for about 16% of GDP in China. Modern chemical products have greatly enriched our material life and improved the quality of life. Moreover, they also play an important role in controlling the disease, increasing the crop yield and developing technologies of national defenses, spaceflights as well as information. However, high-speed developmentof modern chemical industry has also resulted in many problems related to the resources and environment in the worldwide, includingthe growing scarcity of resources on the earth, high price of oil and apparent degradation of ecological environment. In China, problems related to high energy consumption and waste discharge in chemical industries are severe. The energy consumption of unit output value in our country is 3-8 times of that in developed countries, and the amount of carbon emission ranks 1st in the world. Therefore, developing technologies and equipment to improve traditional chemical processes, save energies and reduce emission based on the concept of sustainable development is necessary and urgent at present. Meanwhile, national planning and deploying in fields of energy (energy conservation), water and mineral resources (high efficiency of mineral resources), environment (pollution control and circular utilization of waste), manufacturing industry (green and automation of process industry, development of raw materials), public security, advanced manufacturing technologies (life prediction of major production and facilities), advanced energy technologies (hydrogen energy and fuel cell) and so on do not only bring new missions to research on chemical engineering and chemical process equipment, but also give new opportunities to relate research areas. |
| **Main research topics and progress:**1. Technologies and equipment for cleaner production This topic isdeveloped on the basis of special research on the clean and high efficiency utilization of coal and new energy conservation technologies. At present, this topic consists of investigations on emission control of PM 2.5, metal oxide materials based on grapheme, proton exchange membrane fuel cell (PEMFC), functional plastic films with controllable life-span, hydrophobic ionic liquids for extraction and boron doped diamond film electrode.2. Nanofabrication engineeringThis topic focuses on investigating design and synthetic of new functionalnanoscale biomaterials and developing new application of these materials for medicine, especially the application of intelligent nanoscale drug carrier for treatment and early diagnosis of cancer. 3. Synthetic Biology  This topic consists of two aspects. The first is the design of advanced reverse osmosis/ nano-filtration membrane material and the construction of high performance films. The second is high efficient heterologous expression of nicotinic dehydrogenase and the molecular basis of its substrate recognition. |
| **Member and college:**Our research alliance consists of more than 15 members.Some representatives are listed here.1. WANG Jingdai, College of Chemical and Biological Engineering2.RENQilong, College of Chemical and Biological Engineering3. LEI Lecheng, College of Chemical and Biological Engineering4. SHEN Youqing, College of Chemical and Biological Engineering5. YANG Lirong, College of Chemical and Biological Engineering6. WANGWenjun, College of Chemical and Biological Engineering7. YANKeping, College of Chemical and Biological Engineering8. ZHANGLin, College of Chemical and Biological Engineering9. WUJianping, College of Chemical and Biological Engineering10. HEQinggang, College of Chemical and Biological Engineering |
| **Representative achievements:****1. New technology of olefin polymerization fluidized bed reactor based on acoustic emission detection**The fluidized bed is widely used in many industrial processes because of its vigorous mixing and heat transferproperties. However, when heat transfer is blocked, the particles are easily melted and agglomerated, which may even lead to the shutdown of the industrialreactor. From the point of mechanism analysis, the process of explosive agglomeration is a typical mesoscaleproblem in the fluidized bed, and there is a complex evolution process between particle fluidization and reactor shutdown.Grasping the regulation of mesoscale structure is one of the major challenges faced by chemical engineering. Thus, in thisbackground, the fluidized bed acoustic emission detection technology, agglomeration fault self-repair technology, and a directscale-up technique of the fluidized bed mathematical model were invented. These technologies are reliable forstable operation and have been successfully applied in 14 sets of industrial plants. This technology won the SecondPrize of the State Scientific and Technological Progress Award.**2. New research on acetylene capture from ethylene**The trade-off between physical adsorption capacity and selectivity of porous materials is a major barrier for efficient gas separation and purification through physisorption. This researchreports control over pore chemistry and size in metal coordination networks with hexafluorosilicate and organic linkers for the purpose of preferential binding and orderly assembly of acetylene molecules through cooperative host-guest and/or guest-guest interactions. The specific binding sites for acetylene are validated by modeling and neutron powder diffraction studies. The energies associated with these binding interactions afford high adsorption capacityand selectivity for acetylene at ambient conditions. Results have been published on Science (Science, 2016, 353, 141-145). |