Bioinspired Multiscale Pore/Channel Systems

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"Pore" and "Channel" are everywhere, e.g., from small biological ion channels to large oil pipelines. The difference between pore and channel is the relationship between its diameter and its depth. If the diameter is greater than its depth, it is referred to as Pore, otherwise, Channel. Both "Pore" and "Channel" have a wide range of significant applications on different scales. For example, pipelines which are commonly used in the chemical industry, food industry, agriculture, and energy-petroleum transportation, can be treated as macroscale channels. The problems with such channels center on energy-saving, anti-fouling, anti-corrosion, and anti-block. Another example of micro-scale pores is "liquid gating technology", which has a great impact in the areas of chemical synthesis, biological analysis, optics and information technology, etc. It utilizes the capillarystabilized functional liquid as a pressure-driven, reversible, and reconfigurable gate to fill and seal the pores in the closed state and create completely liquid-lined pores in the open state under pressure changes. Recently, it has already become a reality by design of various smart materials by responsive design of the porous solid phase and dynamic liquid phase, which expand the basic scientific issues of the traditional membrane materials from the solid-liquid/gas interface to the solid-liquid/gas interface and have found applications in chemistry, energy, environmental, and biomedical related interdisciplinary fields. For nano-scale systems, we design and prepare smart symmetric/asymmetric nanochannels by physicochemical design of responsive porous materials and realize the regulation of mass transport in the nanoconfined spaces and focus the new research directions on bioinspired nanofluidic iontronics.

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Figures

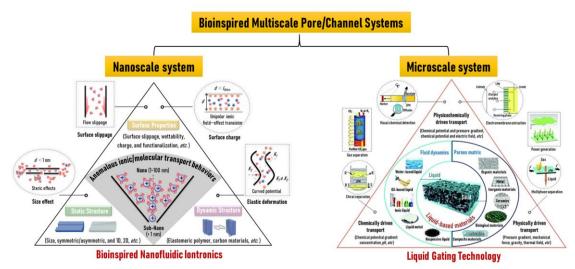


Figure 1: The bioinspired multiscale pore/channel systems.