

Nanomaterials for Sustainable Water Treatment, Reuse and Desalination: Overview of the Caltech-KAIST Collaborative Research Program

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The availability of clean water has emerged as one of the most critical problems facing society and the global economy in the 21st century. Already there is insufficient availability of clean water for human consumption, agriculture and industry. According to the World Resources Institute, 2.3 billion people (~40% of the world's population) live in water-stressed areas. The problem will get much worse unless we develop more efficient and cost-effective technologies to extract clean water from impaired water including wastewater, brackish water and seawater. The California Institute of Technology (Caltech) and the Korea Advanced Institute of Science and Technology (KAIST) have initiated a collaborative research program to address these critical problems. A major goal of this research program is to exploit the unique properties of nanomaterials (e.g. dendritic macromolecules, polymeric nanofibers, carbon nanotubes and oxide nanoparticles) to develop the next generation of sorbents, low-pressure membranes and filtration system, which can extract clean water, energy (e.g. hydrogen) and valuable compounds (e.g. nutrients) and elements (e.g. Li) from wastewater, brackish water and seawater. This presentation will give an overview of the Caltech-KAIST collaboration on sustainable water treatment, reuse and desalination. Selected projects will be highlighted including (i) the development of high capacity and selective nanostructured adsorbents, (ii) the synthesis, characterization of nanofibrous membranes for water treatment and reuse and (iii) the multiscale modeling of water transport and ion rejection by functionalized carbon nanotube membranes.