Materials Science & Engineering Thesis Defense

Development of Hydrogel-based Porous Desiccants for Atmospheric Water Extraction

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Abstract

Atmospheric water extraction (AWE) is an emerging technology to tackle water resource shortage challenges. One such approach to provide fresh water utilizes stimuli-responsive hydrogel-based desiccants to capture the moisture from the air and release it into the liquid form. Typical gel desiccants are composed of a hygroscopic agent for capturing and a hydrophilic gel matrix for storage. The water desorption process can be completed by improving the temperature above the upper or lower critical solution temperature point to initiate the volume phase transition of either thermo-responsive or photothermal types.

This thesis focuses on investigating the structural effect of hydrogel on moisture adsorption. Firstly, the main matrix of gel desiccant, poly(*N*-isopropylacrylamide) hydrogel, was optimized via tuning synthesis temperature and initial monomer concentration. Secondly, a series of hydrogel-based desiccants consisting of a hygroscopic material, vinyl imidazole, and optimized poly(*N*-isopropylacrylamide) gel matrix were synthesized with different network structures. The moisture adsorption result showed that the gel desiccant with an interpenetrating network (IPN) resulted in the best-performing moisture adsorption. The gel desiccant with the best performance will be used as a primary structural unit for other valuable exploration in the future. To evaluate the feasibility of developing a light-responsive gel desiccant to materialize the light-trigger moisture desorption for AWE technology.

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Zoom Link: https://asu.zoom.us/j/4184998710