Public Abstract

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Title:A Comprehensive Report on Preparing and Analyzing Adsorptive Materials Suitable for Hydrogen and Methane Storage

Development of low-pressure, high-capacity adsorbent based storage technology for methane, natural gas, and hydrogen as fuel for advanced transportation is necessary in order to address the temperature, pressure, weight, and volume constraints present in conventional storage methods (CNG, LNG, and LH₂). Subcritical nitrogen adsorption experiments show that our nanoporous carbon hosts extended narrow channels which generate a high surface area and strong van der Waals forces capable of increasing the density of natural gas and hydrogen into high-density fluids. Improvements in storage density over compressed natural gas without an adsorbent occur at ambient temperature and pressures ranging from 0-260 bar. The storage capacity custom built 10.6 L hydrogen adsorption instrument with activated carbon adsorbents synthesized at MU is 32 g/kg at 296 K and 100 bar which is higher than what has been reported in literature for other materials. The temperature, pressure, and storage capacity of a 40 L flat-panel adsorbed natural gas tank filled with 20 kg of activated carbon is featured. Results from the 40 L instrument show that the monolithic adsorbents within allow for rapid charging and discharging and an ideal balance between methane gravimetric and volumetric storage capacity. A 300 kg/(m³ day) space time yield for the production of the monolithic adsorbents is demonstrated.