

Abstract Submitted
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Reversible Storage of Hydrogen and Natural Gas in Nanospace-Engineered Activated Carbons¹ JIMMY ROMANOS, MATT BECKNER, TYLER RASH, PING YU, GALEN SUPPES, PETER PFEIFER, Department of Physics, University of Missouri — An overview is given of the development of advanced nanoporous carbons as storage materials for natural gas (methane) and molecular hydrogen in on-board fuel tanks for next-generation clean automobiles. High specific surface areas, porosities, and sub-nm/supra-nm pore volumes are quantitatively selected by controlling the degree of carbon consumption and metallic potassium intercalation into the carbon lattice during the activation process. Tunable bimodal pore-size distributions of sub-nm and supra-nm pores are established by subcritical nitrogen adsorption. Optimal pore structures for gravimetric and volumetric gas storage, respectively, are presented. Methane and hydrogen adsorption isotherms up to 250 bar on monolithic and powdered activated carbons are reported and validated, using several gravimetric and volumetric instruments. Current best gravimetric and volumetric storage capacities are: 256 g CH₄/kg carbon and 132 g CH₄/liter carbon at 293 K and 35 bar; 26, 44, and 107 g H₂/kg carbon at 303, 194, and 77 K respectively and 100 bar. Adsorbed film density, specific surface area, and binding energy are analyzed separately using the Clausius-Clapeyron equation, Langmuir model, and lattice gas models.

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