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SAFE STORAGE OF GASEOUS FUEL IN A COUPLED STATE: I. METHANE ADSORPTION ON MICROPOROUS CARBON FIBER

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Abstract

Mobile storage of gaseous fuel is the design bottleneck in a commercialization of vehicles powered by natural gas and hydrogen. This paper is devoted the questions of development of the effective system of safe storage of methane and hydrogen in a coupled state by solid adsorbent. A theoretical and experimental study was conducted to determine the methane adsorption by activated carbon fiber based on commercially available "Busofit TM-055" at the full-scale experiment under steady-state conditions. Original experimental setup was developed for carrying out experimental investigation of the processes of adsorption of hydrogenous gases in the different carbon adsorbents and for simulation of gas charging/discharging of a storage cylinder. The experimental data for methane equilibrium adsorption in a wide temperature range between 233 and 313 K and pressure up 5 MPa are obtained and analyzed from the standpoint of the theory of volume filling of micropores and the linearity of the adsorption isosteres. In the supercritical temperature region modified thermal coefficient of limiting adsorption and Dubinin–Astakhov equation are proposed for the prediction of the adsorption isotherms. The adsorption equilibrium data is used to determinate the isosteric heat of adsorption.