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MODELLING OF SATURATED AND UNSATURATED HYDROCARBONS SORPTION ON COAL

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The presence of hydrocarbons can give rise to such phenomena as rock gas outbursts or methane explosions while the coalbed is being mined. The mechanisms of their interactions with the coal bulk have not been fully explained yet. The coal surface contains numerous functional groups, such as oxygen groups, which act as regulators of hydrophilic properties of the coal surface. It is a well-established view that hard coal behaves as a dual system, exhibiting both hydrophobic and hydrophilic properties. This dual nature of the coal surface is of particular importance when investigating the sorption of vapors of apolar and polar substances. Sorbates used in the experiments included aliphatic hydrocarbons as sorbates: ethane, ethene and acetylene. Testing was done on a hard coal sample from a Polish colliery. The presence of a dual bond in the hydrocarbon molecule affects the isotherm pattern and leads to the higher sorption values. The favored sorption of polar hydrocarbons may be associated with the interactions of the dual bond with functional polar groups on the coal surface. Since the saturated and non-saturated hydrocarbon molecule dimensions are very similar, the differences in sorption capacity are probably the result of associations of non-saturated hydrocarbon molecules on the surface of micropores. It is reasonable to suppose that in the case of non-saturated hydrocarbons, adsorbate-adsorbate interactions play a more significant role than adsorbate-adsorbent processes. Results of conducted tests offer us a better insight into the factors controlling the processes of gas sorption and gas release in the hard coal-vapor/gas systems, hence they can be well utilized in prognosticating the gas release to mine workings during the mining operations, rock bursts, rock and gas outbursts and particularly during the self-heating of coal. The obtained experimental isotherms would be fitted by the theoretical models for prediction the sorption processes in other conditions.

Biography

Natalia Czuma is PhD student at AGH University of Science and Technology in Kraków, Poland. In her PhD she focused on the topic of fly ash synthesis and its sorption properties in relation to CO₂ and SO₂. Additionally, her scientific interest focuses on other fly ash uses such as carbonation processes and geopolymer synthesis. She is a member of InnoEnergy PhD School. She has participated in national and international internships including cooperation with EDF Poland SA, Lublin University of Technology, UPC Universitat Polytechnica de Catalunya and Université Pierre et Marie Curie.

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