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MIKOŁAJA KOPERNIKA
W TORUNIU
Wydział Chemii

Wydział Chemii Uniwersytetu Mikołaja Kopernika w Toruniu

Zaprasza na

Seminarium wydziałowe

pod tytułem:

The Asphaltenes: Their Nature and Potential for Applications

wygłoszone przez

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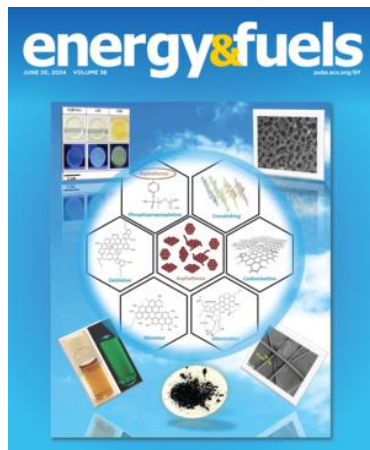
Petroleum Research Center at Kuwait Institute for Scientific Research

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w Bibliotece Wydziału Chemii



ABSTRACT



Petroleum asphaltenes are readily available and the heaviest component and by-product of crude oil. Asphaltenes are problematic in nature and cause severe problems in the petroleum industry. In the present study, we elucidate the structures of asphaltenes at the sub-molecular level by two-dimensional (2D) NMR spectroscopy. Upon clarifying potential reactive functional groups, such as -C=O and -NH , we focus on cross-linking asphaltenes. Successful cross-linking of asphaltenes motivates us to prepare activated nanoporous carbon materials. A thorough characterization of the carbonized nanoporous materials by spectroscopy and thermogravimetric analysis (TGA) confirmed their synthesis. The nanoporosity of the carbonized materials was displayed by scanning electron microscopy (SEM) imaging. Brunauer–Emmett–Teller (BET) surface area analysis shows large surface areas exceeding 2500 and 3000 m^2/g . The newly carbonized materials' architectural rigidity and swelling behavior were tested by the ghost solvent low-field nuclear magnetic resonance (LF-NMR) approach. Finally, the gas adsorption capacity of these materials was tested. The porous carbon structures afforded a hydrogen storage capacity of 2.85 wt % at 1 bar, and the highest uptake of CO_2 at 1 bar is 28.95 and 19.15 wt % at 0 and 22 $^\circ\text{C}$, respectively. Nanoporous carbonized asphaltenes are promising materials for various applications, including gas absorption and CO_2 capture. We suggest that the current materials could serve as reasonable proxies for other applications in microelectronics and solid-state batteries, as heteroatoms such as sulfur are still detectable in the final carbonized nanoporous materials.

BIOGRAPHICAL SKETCH



Dr. Ok earned his Ph.D. at the Leibniz Institute for Polymer Research Dresden, where he completed coursework at the Technical University of Dresden, focusing on advanced NMR techniques to study fluoropolymers. He conducted postdoctoral research at The Ohio State University, the Max Planck Institute in Halle, and Osnabrück University, investigating the dynamics of polymers and confined fluids in nanoporous membranes. Since 2016, he has been a Research Scientist at the Kuwait Institute for Scientific Research, where he co-supervises the spectroscopy laboratory at the Petroleum Research Center.

As Principal Investigator and task leader, Dr. Ok has led projects on polymer thin films, petroleum chemistry, asphaltenes, confined fluids, and electrospun fibers. He has secured over \$1.7 million in funding and published more than 50 peer-reviewed articles, with seven featured on the covers of journals.