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Master Thesis Defense

Entitled

EVALUATION OF A NEW APPROACH FOR QUALITATIVE GAS ANALYSIS BASED ON DIFFUSION PROPERTIES

By

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Abstract

The design and construction of a 6-channel parallel gas diffusion system and its application to evaluate the proposed novel approach for gas fingerprinting are described. The present gas diffusion system allows the simultaneous recording of the pressure accumulation of the permeating test gas behind six different gas permeable membranes, respectively. The obtained simultaneous diffusion rates through different membranes demonstrated clear potential as a new technique for qualitative gas identification of the ten test gases used in the present work. The test gases were helium, neon, argon hydrogen, nitrogen, carbon dioxide, methane, ethane, propane, and ethylene, which are representative examples of mono-, di-, tri- and polyatomic gases. The utilized membranes included Teflon AF, Silicone Rubber, track-etch hydrophilic polycarbonate, track-etch hydrophobic polycarbonate, track-etch polyimide, nano-porous anodic alumina, Zeolite ZSM-5, and Zeolite Nay. Preliminary investigation of the possibility of applying the developed gas diffusion system in semi-quantitative analysis of N_2-CO_2 binary mixture is also reported. Finally, the proposed analogy between the rate of pressure accumulation of the permeating gas into the confined space behind the membrane and the charging of a capacitor in an RC circuit is thoroughly validated both theoretically and experimentally.

Keywords*:* Gas diffusion system, Gas permeable membranes, Qualitative gas fingerprint, Membrane.