Electrical conductivity response and sensitivity of ZSM-5, Y, and mordenite zeolites towards ethanol vapor

Author(s): Yimlamai, I (Yimlamai, Intira)[1]; Niamlang, S (Niamlang, Sumonman)[2]; Chanthaanont, P (Chanthaanont, Pojjawan)[1]; Kunanuraksapong, R (Kunanuraksapong, Ruksapong)[1]; Changkhamchom, S (Changkhamchom, Sairung)[1]; Sirivat, A (Sirivat, Anuvat)[1]

Source: IONICS **Volume:** 17 **Issue:** 7 **Pages:** 607-615 **DOI:** 10.1007/s11581-011-0545-3 **Published:** SEP 2011

Abstract: This work is an attempt to search for highly selective sensing materials for ethanol vapor. The electrical conductivity response of ZSM-5, Y, and mordenite zeolites towards ethanol vapor have been investigated for the effects of the framework, the charge balancing cation type, and the Si/Al ratio. All zeolites were characterized using XRD, FT-IR, SEM, TGA, BET, and NH(3)-TPD techniques. For the effect of the zeolite framework type, H(+)Y has a higher electrical conductivity sensitivity value than that of H(+)MOR because of a greater pore volume and available surface area. For the effect of the charge balancing cation, all NH(4)(+)ZSM-5 zeolites (Si/Al=23, 50, 80, 280) show negative responses, whereas the H(+)Y zeolites (Si/Al=30, 60, 80) and the H(+)MOR zeolites (Si/Al=30, 200) show positive responses. These differing behaviors can be traced to the electrostatic field at the cation sites in zeolite micropores, and their hydrophilic-hydrophobic character, which affect the adsorption properties of the zeolites. For the effect of Si/Al ratio, the electrical conductivity sensitivity towards the ethanol decreases with increasing Si/Al ratio or decreasing Al content, and there is a lesser degree of interaction between ethanol molecules and the active sites of the zeolites due to its higher hydrophobicity and the lower amount of cations. However, the H(+)Y (Si/Al=5.1) and the H(+)MOR (Si/Al=19) zeolites have lower conductivity sensitivity than those of H(+)Y (Si/Al=30) and H(+)MOR (Si/Al=30), respectively. The interactions between the C(2)H(5)OH molecules and the zeolites with respect to the electrical conductivity sensitivity were investigated and verified through infrared spectroscopy.

Addresses:

1. Chulalongkorn Univ, Petr & Petrochem Coll, Bangkok 10330, Thailand

2. Rajamangala Univ Technol Thanyaburi, Fac Engn, Dept Mat & Met Engn, Thanyaburi 12110, Phatum Thani, Thailand

แหล่งอ้างอิง Web of Science