Development of AEI type germanoaluminophosphate (GeAPO-18) with ultra-weak acid sites and its catalytic properties on methanol to olefins (MTO) reactions

Kaito Ono,[a] Koji Miyake,*[a] Masahiro Nakai,[a] Hasna Al Jabri,[a] Yuichiro Hirota,[a] Yoshiaki Uchida,[a] Shunsuke Tanaka,[b] Manabu Miyamoto[c] and Norikazu Nishiyama[a]

a) Division of Chemical Engineering, Graduate School of Engineering Science, Osaka University, 1-3 Machikaneyama, Toyonaka, Osaka 560-8531, Japan
b) Department of Chemical, Energy and Environmental Engineering, Kansai University, 3-3-35 Yamate, Suita, Japan.
c) Department of Chemistry and Biomolecular Science, Gifu University, 1-1 Yanagido, Gifu 501-1193, Japan
k.ono@cheng.es.osaka-u.ac.jp / kojimiyake@cheng.es.osaka-u.ac.jp.

Experimental

The synthesis of AlPO-5

AlPO-5 was prepared using triethylamine (TEA) as the template. Typically, 7.8 g $Al(OH)_3$ (50% Al_2O_3, Aldrich) was stirred with 22.3 g deionized water for 30 min. 8.8 g of phosphoric acid (85% H_3PO_4) was added drop-wise and the mixture was stirred for 90 min. 3.87 g of TEAOH (Aldrich) was added drop-wise and the gel was aged with stirring for 120 min. The composition of this mixture was 0.1 $Al(OH)_3$: 0.08 (H_3PO_4): 0.04 TEAOH: 1.24 H_2O. The gels were divided into several Teflon bottles, placed inside stainless steel autoclaves, and heated in an oven at 453 K for 24 h. The resultant powder was washed with deionized water and dried at 363 K. To remove TEA cations, the obtained powder was calcined under air at 823 K for 5 h.

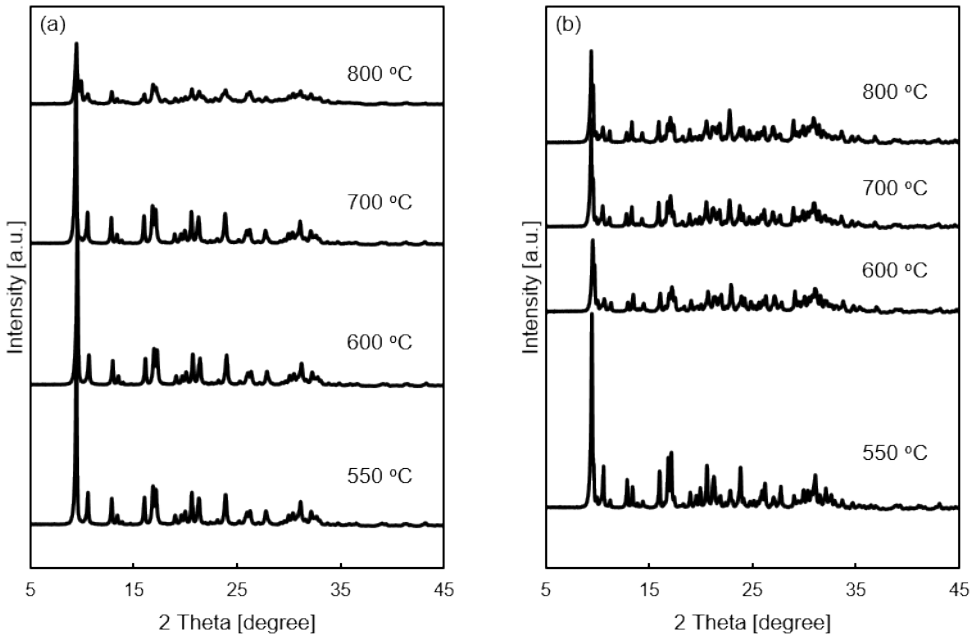

Fig. S1 The patterns of XRD of SAPO-18 (a) and GeAPO-18 (b) with different calcination temperature.

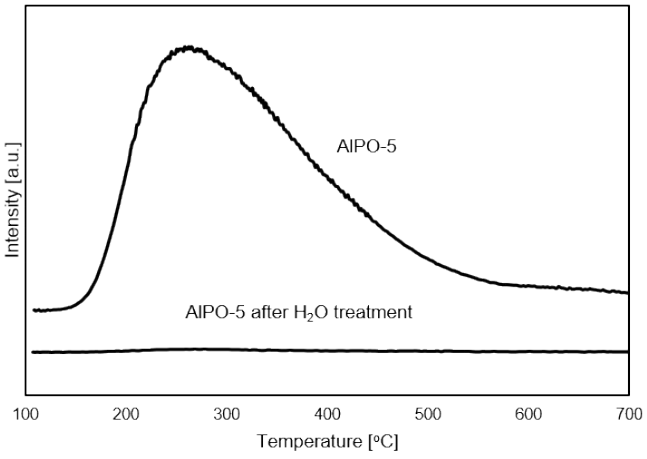

Fig. S2 The NH_3-TPD spectra of AlPO-5 and AlPO-5 after H2O treatment.