On the delamination of layer-structured MCM-22 precursors

Taehee Lee and Jungkyu Choi*
Department of Chemical & Biological Engineering, Korea University, South Korea

*E-mail: jungkyu_choi@korea.ac.kr

MCM-22 precursors (MCM-22(P)), thermally changed into MCM-22 zeolites, have a layered-structure.[1] Specifically, the intra-layers in MCM-22(P) are condensed during the thermal calcination and then, the new inter-layers are generated in-between. This results in the final structure of MCM-22 zeolites. So far, the limited accessibility toward the 12 membered ring (MR) supercages in MCM-22 zeolites has been overcome through the pillaring (MCM-36) or delamination (ITQ-2) of MCM-22. Specifically, a schematic of the conversion of MCM-22(P) into MCM-22, MCM-36, and ITQ-2 is illustrated in Fig. 1.

Although a new approach has been introduced recently,[2] a combination of swelling and sonication is well-known as an effective protocol to delaminate MCM-22 zeolites (i.e., ITQ-2).[3] Despite its promise for increasing the accessibility toward the 12 MR supercages, a harsh condition (~80 °C) for the swelling of MCM-22(P) is expected to damage some parts of the crystal structure in the intra-layers in MCM-22(P). Thus, a benign condition (room temperature) was adopted to swell the MCM-22(P), while preserving the crystallinity of the intra-layers.[4] However, the delamination protocol for ITQ-2 was not effective for delaminating the MCM-22(P) swollen at RT, instead requiring a polymerization reaction that can separate the intra-layers in MCM-22(P).[5]

In this presentation, we would like to address a rigorous analysis on the delamination process of MCM-22(P) and provide an insight into the process through providing a new technique. Based on that, a preliminary result of delaminated MCM-22 will be presented and discussed.

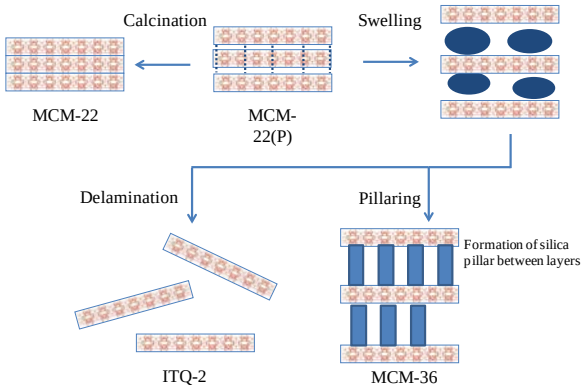

Fig. 1. Schematic of a MCM-22 precursor (MCM-22(P)) and its derivatives; MCM-22, swollen and pillared MCM-36, and swollen and delaminated ITQ-2.

REFERENCES

[1] M.E. Leonowicz, J.A. Lawton, S.L. Lawton, M.K. Rubin, Science 264, (1994) 1910-1913.
[2] I. Ogino, M.M. Nigra, S.J. Hwang, J.M. Ha, T. Rea, S.I. Zones, A. Katz, Journal of the American Chemical Society 133, (2011) 3288-3291.
[3] A. Corma, V. Fornes, S.B. Pergher, T.L.M. Maesen, J.G. Buglass, Nature 396, (1998) 353-356.
[4] S. Maheshwari, E. Jordan, S. Kumar, F.S. Bates, R.L. Penn, D.F. Shantz, M. Tsapatsis, J. Am. Chem. Soc. 130, (2008) 1507-1516.
[5] K. Varoon, X.Y. Zhang, B. Elyassi, D.D. Brewer, M. Gettel, S. Kumar, J.A. Lee, S. Maheshwari, A. Mittal, C.Y. Sung, M. Cococcioni, L.F. Francis, A.V. McCormick, K.A. Mkhoyan, M. Tsapatsis, Science 333, (2011) 72-75.