

successful placement of precursors can be accomplished within a large pore parent zeolite structure via post-synthesis exchange or during hydrothermal crystallization. This parent structure, containing metal clusters within its microporous voids, can then be recrystallized without loss of encapsulation into a daughter structure of higher framework density, for example MFI (ZSM-5), for which more direct methods of encapsulation are unavailable or impractical. The transformation also occurs without use of an SDA. The overall process is efficient and facile.

[0010a] Also provided is a zeolite containing metal prepared by the method as described herein.

Brief Description of the Drawings

[0011] FIGURE 1 shows X-ray diffraction patterns of the products synthesized from (i) BEA ($\text{Si}/\text{Al} = 37.5$) and (ii) FAU ($\text{Si}/\text{Al} = 40$) parent zeolites via (a) direct, (b) template-assisted (using TPABr), and (c) seed-assisted transformations (using MFI seeds). Syntheses were carried out at 423 K, $\text{NaOH}/\text{SiO}_2 = 0.35$ (from BEA) and 0.50 (from FAU) and $\text{H}_2\text{O}/\text{SiO}_2 = 65$ (from BEA) and 95 (from FAU) (Table 1).

[0012] FIGURE 2 shows X-ray diffraction patterns of MFI products synthesized by interzeolite transformations of (a) BEA and (b) FAU containing metal clusters as parent zeolites. Syntheses were carried out at molar composition 0.35 NaOH: 1.0 SiO_2 : 0.0133 Al_2O_3 : 65.0 H_2O from BEA without seeds and 0.50 NaOH: 1.0 SiO_2 : 0.0125 Al_2O_3 : 95.0 H_2O from FAU with 10 % wt. MFI seeds at 423 K (Table 1).

[0013] FIGURE 3 shows TEM images and metal cluster size distributions of parent (a) BEA and (b) FAU zeolites containing Pt clusters, synthesized by ion exchange methods and (c) Pt clusters dispersed on SiO_2 , synthesized by incipient wetness impregnation method.

[0014] FIGURE 4 shows TEM images and metal cluster size distributions of Pt containing MFI samples synthesized by interzeolite transformations of (a) BEA and (b) FAU zeolites containing Pt clusters as parent materials.

[0015] FIGURE 5 shows TEM images of (a) Ru containing MFI synthesized by interzeolite transformation of Ru/BEA and (b) Ru and (c) Rh containing MFI synthesized by interzeolite transformations of Ru and Rh containing FAU as parent zeolites.

[0016] FIGURE 6 shows schematic representation of the synthesis factors that limit encapsulation of metal clusters within MFI over a broad range of synthesis conditions. Mi represents the synthesis method used (see Table 5).