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Preparation of Pt-5A Molecular Sieve

Recently Rockova studied chemisorption on Pt supported on a 5A molecular sieve (*1*). The purpose of this letter is to remove a possible incorrect impression which Rockova may have given concerning the preparation of Pt-5A. She used a platinum ammine chloride exchange procedure to prepare Pt-5A and cited a method described by Frilette and Maatman (*2*). There is no reason to believe that one can use this procedure to put Pt into the 5A cavities. Thus, in the work Rockova cited, we reported an attempt to put Pt into the 5A cavities using the exchange method. In this attempt we produced a Pt-5A material (1.66% Pt) active in the hydrogenation of liquid benzene. The product was cyclohexane; the reaction was carried out at 63°C with 30 psi of H_2, and 3.82×10^{-3} mol of benzene was converted per hour per gram of catalyst. Using a standard $Pt–SiO_2$ catalyst (1.02% Pt) in the same test, 21.4×10^{-3} mol of benzene was converted per hour per gram of catalyst (*2*). Pt not in the cavities would be poorly dispersed; that is, it would be deposited in cracks, etc. Since the benzene molecule is too large to enter the 5A cavities, the hydrogenation which was observed with Pt-5A was apparently due to poorly dispersed, noncavity Pt. We found no evidence that a Pt impregnation method could be used to put Pt into 5A cavities. We did show, however, that by Pt ammine chloride impregnation that Pt could be put into cavities having larger "windows," the cavities of the 10X and 13X molecular sieves (*2*).

Also, Rockova does not seem to present evidence showing that the Pt in her Pt-5A material was anything other than poorly dispersed. In fact, she concludes that some of the platinum was "present on the outer surface and in the cracks of the carrier structure" (*1*).

We were successful in placing Pt in the 5A cavity by using an entirely different preparation method, one in which the Pt species is present when the A cavity forms (*3*). Using a Pt-5A material (0.31% Pt) prepared in this way, we attempted to hydrogenate a mixture of *n*-butene-1 and isobutene. The same experiment was carried out using a standard $Pt–SiO_2$ (0.35% Pt) catalyst. The catalyst, conversion of *n*-butene-1, and conversion of isobutene, respectively, were as follows: Pt-5A, 22 and 0%; $Pt–SiO_2$, 47 and 20%. Evidently the molecule with the larger cross section, isobutene, could not contact the Pt in this Pt-5A material (*3*). This was one of the results which led us to conclude that catalytic Pt can be put into the A cavity by having a Pt species present when the A cavity forms, and that there is no need, when a Pt-5A material is made, to deposit Pt in cracks and in a generally undefined way.

REFERENCES

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