Supported bimetallic particle catalysts (with particle sizes a few nanometers) are being increasingly used in heterogeneous catalysis due to their enhanced selectivity introduced by changes in their surface and electronic structure. Cu–Pd supported on carbon is of interest to commercial methanol synthesis reactions. Using an in-situ 1 MeV EM fitted with a gas reaction cell, reactions in H2 and CO are monitored and different sintering behavior has been obtained. Surface defect layers of up to only a few angstroms in the reacted catalysts have been observed by high resolution microscopy using a JEOL 200CX and a JEOL 4000EX HREMS. Particle structures are identified by convergent beam diffraction patterns. High precision microanalysis with probe sizes 3–5 nm has indicated preferential surface enrichment of Pd. The surface structure information is critical to the understanding of chemisorption of the synthesis gases and therefore, to activity. Based on the microanalysis and HREM results, calculations of these complex images have been carried out using 256×256 FFTs (arrays) in the multislice programmes. The calculations in the image contrast between the two models and experimental data. It is shown for the first time that even a monolayer coverage of a particular species on the nanometre size particles can be distinguished.

Lattice inclusion selectivity and guest discrimination

Selectivity studies showed preferential complexation of the enantiomers is achieved. To investigate the chiral discrimination, a racemic mixture of some phosphinates and phosphinic acids is located at the center of the host cavity, while iodine and 1-propanol molecules are shifted toward the wider O(2), O(3) side from the center of the cavity. Dihydro-α-CBx molecules are arranged to form a typical cage type packing in the crystal.

The crystal structures have been determined for pairs of diastereoisomeric salts that may result from the reaction of enantiomers of the organic amines. R,R-tartaric acid is a widely used reagent for the resolution of optically active amines. The two different diastereoisomeric salts that may result from the reaction can differ so much in their relative solubilities that an almost quantitative separation of the enantiomers is achieved. To investigate the chiral discrimination, we have determined the crystal structures of a number of diastereoisomeric salts. As it is the aim to relate the differences between the intermolecular interactions in these compounds shows that both hydrogen bonds and non-bonded interactions are important for the crystal packing. A qualitative comparison between the intermolecular interactions in these compounds shows that both hydrogen bonds and non-bonded interactions are important for the crystal packing.