

Use of Zeta Potential Measurements in Catalyst Characterization

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Although finely divided particle technology constitutes an integral part of heterogeneous catalysis, the techniques of colloid chemistry have not been widely applied to zeolite characterization. Small particles often contain charged surfaces arising from surface groups ionizing, charged ions adsorbing from solution, or isomorphous cations or anions substituting into a lattice. In addition a layer of counter ions is firmly held to the particle to achieve partial neutrality. Zeta potential measures the potential at the shear plane separating this compact layer from the weaker held diffuse layer and we can monitor surface changes in relatively concentrated slurries. The zeta potential reflects the chemical character of the surface layer of the catalyst.

We will illustrate how we have used zeta potential measurements in several problems. First we will show an excellent correlation between the isoelectric point of a suite of faujasites with the surface Si/Al ratio as determined from XPS measurements, giving us a simple way of monitoring surface changes. We have used these surface properties in controlling the strength of composite FCC catalysts. We will also show how zeta potential measurements can help in understanding metal dispersion on supports by using electrostatic interactions to improve dispersion of the metal precursors. In another example, we use zeta potential measurements to compare differences between surface and bulk cha