ZirChrom®

Technical Bulletin #100

... For Peak Performance

Comparison of Zirconia, Silica and Polymeric

Zirconia, or zirconium dioxide (ZrO2), is a metal oxide that can exist in a number of crystallographic and amorphous forms. The porous zirconia that is used for ZirChromÒ columns is produced through the controlled polymerization induced aggregation of 1000Å colloidal zirconia to produce monodisperse 3 micron porous zirconia spheres. These zirconia spheres are then sintered at temperatures reaching 900oC to produce a monoclinic crystallographic zirconia form. The primary advantage of zirconia over other types of chromatographic materials used in HPLC today are summarized in the following table that lists ideal chromatographic properties (1):

++ = Very good; + = good performance; - = fair performance.

HPLC Property	Zirconia	Silica	Polymeric
Mechanical Stability	++	++	+
High Surface Area	++	++	++
Control of Average Pore Diameter	++	++	+
Control of Average Particle Diameter	++	++	++
Chemically Flexible	+	++	+
Energetically Homogeneous	-	-	+
Swelling	++	++	-
Chemical Stability (to acid and base)	++	-	++
Thermal Stability	++	+	-

As shown above, the primary advantage of zirconia over either silica or polymeric stationary phases is its extreme chemical and thermal stability. Unlike silica, zirconia is completely stable over the entire pH range and at elevated column temperatures as high as 200oC. Unlike polymeric phases, zirconia does not shrink or swell as a function of mobile phase organic content or ionic strength, and it has very high mechanical strength. This extreme stability results in a column that may be cleaned under harsh conditions (acidic or basic), and also results in a much longer column lifetime. Long column life and stability translates to a reduced cost per analysis and a wider range of possible chromatographic conditions.

(1) J. Nawrocki, M.P. Rigney, A. McCormick, P.W. Carr, J. of Chromatogr., 657 (1993) 229-282.