The effect of adding selected electrolytes on the surface area of nano-sized silica particles

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Abstract

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Introduction:

Chemically modified and functionalised silica nanoparticles are finding applications in many areas of science and technology. The surface density of the functionalisation can however be limited by the low surface areas (typically by BET 10-20m^2/g) of silicas prepared by sol-gel chemistries based on the original Stober procedure. Here we report the effect of adding selected electrolytes on the surface area of nano-sized silica particles.

Method:

1g of silica particles, prepared by alkoxysilane hydrolysis procedure, was washed and dried under vacuum, then transferred to a 50 ml polypropylene tube. 40 ml of (1M) electrolyte was added to the tube (method I). In method(II) the electrolyte was added during silica particles formation.

Results and Discussion:

The study shows that addition of electrolyte during the particles formation has an obvious impact on the surface area, particles size and morphology comparing to adding electrolyte to pre-prepared particles. Furthermore, the adding of NaCl (1M) during the particles formation increases the surface area significantly.

Batches	Surface area, m^2g^{-1}	Total pore volume, cm^3g^{-1}	Average pore diameter, Å
Nanosilica without treatment	10.98	0.0257	93.71
Nanosilica treated with (1M) NaF	13.04	0.0309	114.5
Nanosilica treated with (1M) NaF during particles formation	6.49	0.0177	109.3
Nanosilica treated with (1M) NaCl during particles formation (1 hour)	49.3	0.1256	101.9
Nanosilica treated with (1M) NaCl during particles formation (24 hour)	354	0.309	35.02

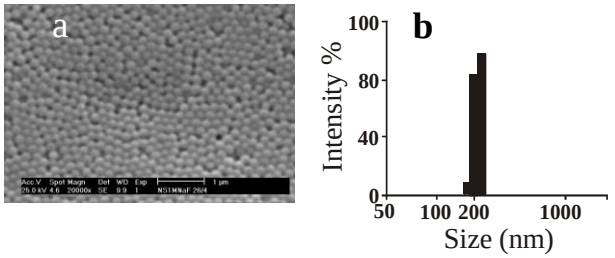

Fig 1: SEM image of silica particles treated with 1M NaF (a) and the mean particle size distribution of the same sample(b)

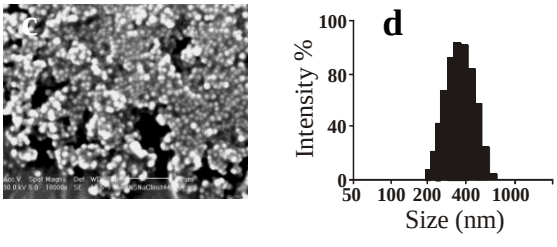

Fig 2: SEM image of silica particles treated with 1M NaCl during particles formation (c)and The mean particle size distribution (d)