RAPET (Reactions under Autogenic Pressure at Elevated Temperatures)

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RAPET is a reaction that takes place in a closed cell (a SWEGELOCK union) under the pressure created by the material introduced in the cell. There is no catalyst, no solvent there is only the material we study. We have dissociated various transition metal alkoxides and also tetraethoxy silane under their autogenic pressure at temperatures varying between 500-900 °C. Three types of products were obtained. In the first case, the dissociation of tetraethoxy silane, a carbon core surrounded by a thin shell of silicon (15 nm) was obtained1. A different product was obtained for Mo and V alkoxides. It revealed a transition metal oxide core, and a carbon shell. The third product which was obtained in the thermolysis of Ti(OEt)4 showed spheres which contain titania (anatase) and carbon without any boundary separation. In most of the cases the product had a spherical shape. The RAPET reactions of the Mo and V alkoxides were also conducted between the poles of a magnetic field. While for the Vanadium there was no magnetic field effect, for Mo completely different products were obtained. Instead of a core-shell structure two separated nanoparticles, carbon, and MoO2 were detected. The dissociation of mesitylene2 and camphore under their autogenic pressure yielded carbon spheres whose diameter was 2.5 micrometers. The yield of the products in this reaction is 84% and a very narrow size distribution is obtained. Attempts to change the radius of the carbon sphere by varying the dissociation temperature, the heating rate, amount of precursor have failed, the only factors that had an affect on the shape of the products was an applied magnetic field and a sudden cooling of the reaction cell. When the reaction was carried out between the poles of the magnetic field long sausages (32 micron long) were observed. If patent regulation will allow we will also show how we can synthesize one of the most useful materials, by RAPET, and get the smallest particles (highest surface area as well) ever reported for this material.

References

1) “Thermal Decomposition of Tetraethylorthosilicate (TEOS) Produces Silicon Coated Carbon Spheres” V. G. Pol, Swati V. Pol, A. Gedanken, Y. Gofer
