CHARACTERIZATION OF NANO-SIZED TITANIUM DIOXIDE

[1]Gunel Imanova, [1]Sevinj Melikova, [1]Anar Aliyev, [1]Zaur Mansimov,
[1,2]Matlab Mirzayev, [1]Salimkhan Aliyev

[1]Institute of Radiation Problems, Minister of Science and Education Republic of Azerbaijan, Baku AZ-1143, B. Vahabzade 9, Azerbaijan

[2]Joint Institute for Nuclear Research, Dubna, Russia

Titanium dioxide pigments are finely divided white powders which are chemically inert or unreactive, in contrast to all commonly used materials for paper filling or coating systems, and are used to increase opacity. There are three naturally occurring crystallographic forms of titanium dioxide: anatase, brookite and rutile. Rutile is the most common and stable form. Its structure, shown in Figure 1 (a), is based on a slightly distorted hexagonal close-packing of oxygen atoms with the titanium atoms occupying half of the octahedral interstices. Anatase and brookite are both based on cubic packing of the oxygen atoms, but the coordination of the titanium is again octahedral.

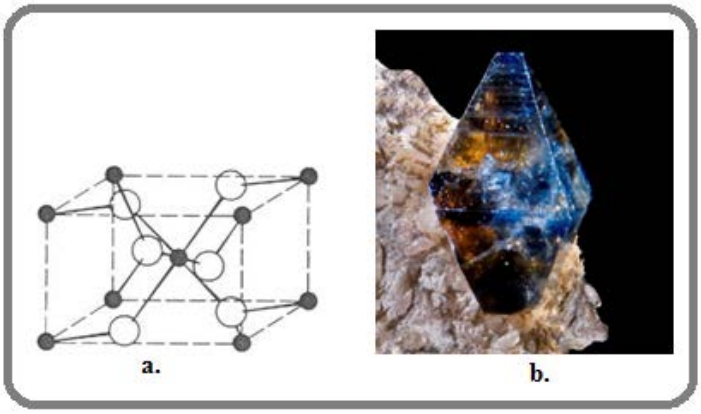

Figure 1. a) Unit cell of rutile. Black circles: titanium atoms; open circles: oxygen atoms. b) Photograph of a crystal of anatase

Anatase, a natural mineral, is one of the polymorph of TiO_2. The name “anatase” is derived from the Greek word “ana,” which means “elongated” and refers to the mineral crystal's shape (Figure 1 (b)). Using Wulff construction and calculated surface energies, the equilibrium shape of a TiO_2 anatase crystal has been predicted to consist of a truncated octahedron, which agrees with experimental observations. The role of anions during solution-based synthesis of inorganic compounds is multiple. Depending on their complexing ability toward cations, anions can drive the nucleation/crystallization toward a specific crystal structure. They can also adsorb onto surfaces thus orienting, in a particular direction, the growth of particles.