

The Synthesis of $\text{Ti}(\text{OH})_3\text{Cl}\cdot 2\text{H}_2\text{O}$ Crystal Hydrate Precursor

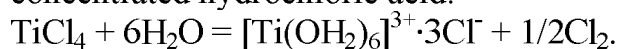
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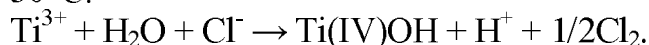
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The investigations related to the receipt of $\text{Ti}(\text{OH})_3\text{Cl}\cdot 2\text{H}_2\text{O}$ crystal hydrate compound, used as a precursor to produce of TiO_2 nanocrystalline modifications (rutile or anatase), are conducted.

This crystal hydrate compound is crystallized from $[\text{Ti}(\text{OH}_2)_6]^{3+}\cdot 3\text{Cl}^-$ solution. A solution of titanium aqua-cations is obtained by mixing TiCl_4 with concentrated hydrochloric acid:



Coordinating bond of water molecules with titanium atoms in precursor cations reduces the activation energy of the reaction of their dissociation because chemical equilibrium in a solution is disturbed at the temperature more that 30°C :



$[\text{Ti}(\text{OH})(\text{OH}_2)_5]^{3+}$ cations formed, then also change their chemical state under the temperature influence, increasing the hydroxility degree of titanium atoms:



The crystal hydrate form of titanium precursor is obtained as result of “cold” dehydration of solution. For this purpose, the partial pressure of H_2O and HCl molecules was low over the solution, using CaO adsorbent. $[\text{Ti}(\text{OH})_3(\text{OH}_2)_3]^+\cdot \text{Cl}^-$ complex compound is transformed into $\text{Ti}(\text{OH})_3\text{Cl}\cdot 2\text{H}_2\text{O}$ crystal hydrate at the end of the dehydration process.

Needle-shaped rutile nanoparticles of 3-5 nm in diameter and 12-18 nm in length are formed from the precursor solution in an aqueous medium at a temperature of 40°C .

Spherical anatase nanoparticles of 4-6 nm in diameter are formed at the presence in solution of small amount SO_4^{2-} or PO_4^{3-} anions-promoter.