

# Hydrothermal Reactions for Synthesis/Preparation of Nano-Materials with Desired Shapes, Sizes and Structures for Oxides and Carbons

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Hydrothermal reactions have more widely been recognized in natural and artificial systems on the earth<sup>1)</sup>. Particularly, the formation, production, alteration, decomposition of all substances and materials in natural systems are always related with the action of water (aqueous solutions). The origin and development of life might be influenced by the action of aqueous solutions most probably around the hydrothermal vents in deep sea<sup>2)</sup>. Not only the bio-systems but also artificial materials systems can be related to the actions of water.

In the present lectures, I will summarize Hydrothermal reactions on various natural and artificial materials. [1]Hydrothermal Syntheses of Nano-particles<sup>3)</sup>, ZrO<sub>2</sub>, CeO<sub>2</sub>, (Zr,Ce)O<sub>2</sub>, HAp, Fe<sub>3</sub>O<sub>4</sub>, TiO<sub>2</sub>, BaTiO<sub>3</sub>, etc. [2]Nanostructured Films<sup>2,4)</sup> of BaTiO<sub>3</sub>, SrTiO<sub>3</sub>, LiCoO<sub>2</sub>, BaWO<sub>4</sub>, CaWO<sub>4</sub>, HAp etc., and [3] Nanostructured Patterns<sup>5)</sup> of BaTiO<sub>3</sub>, Carbon, etc. established in our group will be reviewed. In the formation of films, additional activation(s) with thermal one are very useful. Particularly electrochemistry is very attractive to prepare oxide films and patterns. Recent proposal: Growing Integration Layer[ GIL] method<sup>6)</sup> is also using electrochemistry to make oxide layer(s) on metallic material(s) to improve adhesion, anti-oxidation, bioactivity and/or other functionalities. A novel subject, "Hydrothermal Carbons"<sup>7-12)</sup> where various nano-carbon materials can be prepared by hydrothermal reactions, is summarized, then recent Graphene and functionalized Graphene formation in solutions will also be introduced<sup>13-15)</sup>. If I have a time, I will talk about "How we can learn from literature then exceed it to create true originality in our research?" and "Importance of writing in note book(s) to improve one's understanding for efficient study/research."

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