

SUPERCRITICAL HYDROTHERMAL SYNTHESIS OF NANO PARTICLES

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We are developing a new process of supercritical hydrothermal synthesis of nano particles. In the proposed method, metal salt aqueous solution is mixed with high temperature water to rapidly increase the temperature of the metal salt solution and thus reduce the reactions and crystallizations during the heating up period. By using this method, we succeeded in the continuous and rapid production of nano crystals. In this paper, the specific features of supercritical fluid processes for material synthesis and processing are summarized. Several key features have been found: (i) nano particle formation, (ii) single crystal formation, (iii) ability to control particle morphology to some extent with pressure and temperature, and (iv) ability to provide homogeneous reducing or oxidizing atmospheres by introducing gases or additional components (O₂, H₂). The method has been used for various applications, including magnetic material (BaO₆Fe₂O₃), phosphor (Tb:YAG), metallic Ni nano particles, Li ion battery material (LiCoO₂, LiMn₂O₄). This paper will discuss the mechanism of this process with comparing the results at subcritical conditions, that leads to clarify the key features of this method.