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Micrometers to nanometers conversion process in perovskite BaTiO₃ particles

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A one-step “top-down” process was proposed in this work to obtain nanoparticle products of tetragonal barium titanate (BaTiO₃; BT) with highly accurate stoichiometry and morphological control. A micrometer-sized BT precursor significantly decreases to nanometer-sized product particles and its irregular shape changes to nearly spherical with narrow size distribution via surface active etching. Both XRD and Raman results of BaTiO₃ nanoparticles indicated a tetragonal crystal structure. The 77.5 ± 2.5 nm sized BaTiO₃ powder product still polarized spontaneously at room temperature and the ferroelectric phase transition was confirmed at around 127 °C. Dielectric permittivity was found to be ~ 166.42 by Landauer-Bruggeman effective medium approximation (LB-RMA). Experimental procedures revealed a possible process mechanism observed within the etched surface and Oriented-attachment growth models, and this demonstrated approach could be used as an excellent platform for preparing advanced ceramic nanoparticles.

Primary author: CHAROONSUK, Thitirat

Co-author: Prof. VITTAYAKORN, Wanwilai (Collage of Nanotechnology, King Mongkut’s Institute of Technology Ladkrabang)

Presenter: CHAROONSUK, Thitirat

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