Large-scale Synthesis of Perovskite Nanostructures

Ternary transition metal oxides, including BaTiO$_3$ and SrTiO$_3$, with a perovskite structure, are noteworthy for their exceptional dielectric, piezoelectric, electrostrictive, pyroelectric, and electro-optic properties. Understanding the behavior and preparation of these ferroelectric materials with structure-dependent physical properties, at the nanoscale level, are of great importance to the development of molecular electronics.

**Benefits:**

- Controlled formation of different morphologies of barium and strontium titante nanostructures
- Organometallic precursors are not used, which can be toxic, expensive and unstable
- Potential expansion of method to large-scale synthesis/preparation of ferroelectric systems at the nanoscale level

Single-crystalline BaTiO$_3$ nanowires and SrTiO$_3$ nanocubes have been prepared with a novel and simple one-step solid-state reaction in the presence of NaCl and a nonionic surfactant. These single crystalline perovskite structures that can be reproducibly fabricated using a large-scale, facile solid-state reaction that employs environmentally friendly reactants. The exact shape of the nanostructure, i.e. nanowires, nanoparticles or nanocubes, is dependent upon the reaction conditions employed.

Understanding the behavior and preparation of these ferroelectric materials with structure-dependent physical properties, at the nanoscale level, are of importance to the development of molecular electronics. Potential applications include: nonvolatile memory, dynamic random access memory (DRAM), field-effect transistors, electrooptic devices, electromechanical devices, and logic circuitry.

**Applications:**

- Dielectrics, Piezoelectrics, Electromechanical Devices
- Nonvolatile memory
- Dynamic random access memory

**Patents / Publications:**

- PCT/US2005/019668

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