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Properties and fabrication of functional oxide nanoparticles for future electronic devices

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Abstract

Functional oxide nanoparticles (NPs) are promising materials for the development of novel electronic devices. We developed advanced methods for fabricating oxide NPs of ferroelectrics and semiconductors with average sizes smaller than 10 nm. Superior performance of NPs will be realized by controlling size-driven properties. The recent trend of downsizing electronic components demands a reduction in the size of ferroelectric materials. Barium titanate ($BaTiO_3$), which is one of the most promising ferroelectrics, is commonly used for dielectric layers in multi-layer ceramic capacitors (MLCCs). Fabrication of $BaTiO_3$ NPs allowed us to investigate size-induced phase transformation and their dielectric properties. This will be advantageous for the design of future MLCCs that requires much thinner dielectric layers. Also, it is important to develop functional oxide NPs using abundant, inexpensive and environmentally benign elements for prevailing sustainable society. The oxide NPs such as zinc oxide (ZnO) and cuprous oxide (Cu_2O) are key functional materials for realizing advanced and green nanodevices. The NPs of both ZnO and Cu_2O were successfully fabricated and their quantum size effects were systematically investigated. This will not only aid the clarification of their intrinsic properties, but also be useful for the production of novel electronic and optical devices that are compatible with sustainable society.

Biography

Dr. Keigo Suzuki is an Associate Chief Researcher in the Nano Technology Development Department at Murata Manufacturing Co., Ltd. in Kyoto, Japan. He received the Bachelor of Engineering degree in 1997 and the Master of Engineering degree in 1999 in Materials Science from the University of Tokyo. He joined Murata Mfg. Co., Ltd. in 1999 and started his original research in the field of functional nanoparticles. He received his Ph. D. degree in Engineering from Kyoto Institute of Technology in 2006. He has been actively involved in fabrication and nano-scale characterization of functional oxide nanoparticles for the development of novel electronic devices. He has authored and co-authored more than 25 papers in the research field of nanoscience.