http://dx.doi.org/10.4172/2169-0022.S1.010

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Materials Science & Engineering
October 07-09, 2013 Hampton Inn Tropicana, Las Vegas, NV, USA

Atomic-level precise artificial atom towards material innovation

Norifusa Satoh
National Institute for Materials Science, Japan

Atom limits the physical property of materials because the atomic size, mass, valence, and orbital naturally determine the bond length and angle, lattice vibration, and electronic band structure of materials. To overcome the limitations in material science, quantized charging dots have attracted much attention as artificial atoms due to freedom to design the artificial-atomic size and bond length and angle in creation of artificial molecules and materials. To obtain an ideal artificial atom at room temperature (RT), the tiny dots need to be less than 2 nm in size so that the charging energy of each single electron exceeds the thermal energy at RT. It is significantly important to clearly distinguish the quantum confinement of electron from the quantum confinement of excition to explain the optical size effect; the size interest is <2 nm for confining electron and 2-50 nm for confining excition. Besides, reorganization of the surroundings dominates electron transfer in molecular scale as described by Marcus theory, which is totally different with electron tunneling adopted in nano scale. Therefore, we established a method to deposit molecular-scale uniform dots surrounded seamlessly with consistent dielectric materials through atomic-level control of oxide; oxide is beneficial to obtain atomic-level precise structures due to the strong binding energy of ionic covalent bond and appropriate for our sustainable development thanks to the abundance of oxygen in the earth. The oxide-based artificial atoms will lead to artificial materials overcoming the restrictions by the atomic properties.

Biography

Norifusa Satoh received his Ph.D. from Keio University with honors in 2006. After serving as a postdoctoral researcher and an Assistant Professor at Keio University, he moved to National Institute for Materials Science (NIMS) as a permanent staff researcher in 2009. During 2011-2013, he was a visiting scientist at Harvard University. Through his wide range of experiences manipulating atoms and electrons in molecular chemistry, he aims to apply the fundamental concepts to oxide-based materials and electronics.

SATOH.Norifusa@nims.go.jp