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Atomic-level precise artificial atom towards the global energy problem

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Abstract

The global energy problems originated from the limitation of fossil fuels are strongly related to the limitation of elemental resources. Not only as energy source, we depend on fossil fuels as carbon source in the chemical industry. Although energy storage is important for long-term energy security, the current energy-storage devices like lithium ion batteries require organic solvents obtained from fossil fuels to smoothly transport ions. Thus, it will be difficult fabricate high-performance energy-storage devices after we lost fossil fuels. On the other hands, energy-generating devices including solar cells necessitate rare metals because the atomic properties naturally determine the material properties. It means that we cannot supply high-efficiency energy-generating devices to all over the world. In short, we cannot fully save the future energy security using the current technologies. As a first step to overcome the obstacles, we fabricate an oxide-based artificial atom through atomic-level control of oxide structure because oxygen is the most abundant element existing as oxides on the earth. Since the oxide-based artificial atoms will lead to (1) artificial materials unlimited by atomic properties in the electronic properties, (2) energy-storage devices free from ion transports, and (3) energy-saving electronics, this will contribute to our sustainable development toward the low carbon society.

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 is 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.