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Tuning electrical conductivity with photoirradiation and electric field in organic crystals and ionic solids

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Control of electrical conductivity by using external stimuli such as photoirradiation and electric field is one of the major subjects in materials science because of prospects for the discovery of potential optoelectronic materials. Electrical conductivity has been measured with and without photoirradiation and electric fields with special attention to organic molecular conductors. With a visible nanosecond pulsed laser light in the presence of electric field, for example, a switching of the electrical conductivity is observed. Moreover, the conductivity switching shows an unprecedented memory effect, of which the appearance is governed by temporal width and height of pulsed electric fields. In some single crystals, the Mott insulating phase is converted to the metallic phase by application of electric fields without photoirradiation. The threshold voltage for the transition is reduced by photoirradiation, that is, the synergy effect of the photoirradiation and electric field is observed. A gigantic photoinduced change in ionic conductivity has been also observed in AgI crystals. With photoirradiation, potential functionality in the molecular conductors and the ionic conductor can be revealed. The results are obtained as a part of our strategy toward the realization of photoinduced superconductivity or photoinduced superionic conductivity, which is one of the most challenging problems in materials science.

Biography

Nobuhiro Ohta has completed his PhD from Tohoku University, Sendai, Japan, and Post-doctoral studies from Marquette University in Milwaukee. Until March 2015, he was Professor at Hokkaido University, Sapporo, Japan. He is now Chair Professor at National Chiao Tung University, Hsinchu, Taiwan and Professor Emeritus at Hokkaido University. He has published more than 200 papers in reputed journals. He has focused on Photoelectric and photobioelectric research, where novel materials functions and novel biological function are quested by photoirradiation and application of electric field.

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