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Terahertz Investigations of Extraordinarily Efficient Conduction in a Redox Active Ionic Liquid. VERNER THORSMOLLE, JAN BRAUER, École Polytechnique Fédérale de Lausanne, GUIDO ROTHENBERGER, Polytechnique Fédérale de Lausanne, DAIBIN KUANG, Sun Yat-Sen University, SHAIK ZAKEERUDDIN, MICHAEL GRÄTZEL, JACQUES MOSER, Polytechnique Fédérale de Lausanne — Iodine added to iodide-based ionic liquids leads to extraordinarily efficient charge transport, vastly exceeding expectancy for such viscous systems. Using terahertz time-domain spectroscopy, in conjunction with dc conductivity and viscosity measurements we unravel the conductivity pathways in 1-methyl-3-propylimidazolium iodide melts. Applying low temperatures, we demonstrate for the first time conduction entirely due to a Grotthus bond-exchange mechanism at iodine concentrations higher than 3.9 M. The terahertz and transport results are reconciled in a model providing a quantitative description of the conduction by physical diffusion and the Grotthus bond-exchange process. These novel results are of great importance for the fundamental understanding of conduction in molten salts and for applications where ionic liquids are used as charge-transporting media such as in batteries and dye-sensitized solar cells.

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