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Charge Transport in Trehalose-Derived Sugar Glasses LOUIS NEMZER, Nova Southeastern University, MAHANTESH NAVATI, JOEL FRIEDMAN, Albert Einstein College of Medicine, ARTHUR EPSTEIN, Ohio State University — Trehalose is a naturally occurring disaccharide with a well-known ability to preserve the biological function of proteins and cell membranes during periods of stress, including dehydration, by stabilizing the conformations of the macromolecules within a glassy matrix. This phenomenon makes use of the propensity of trehalose to interact strongly with protein functional groups and solvating water molecules via hydrogen bonding. Recently, it has been shown that trehalose sugar glasses also support long range charge transport in the form of oxidation-reduction reactions occurring between spatially separated donors and acceptors. Based on an Arrhenius conductivity analysis, along with IR-absorption and dielectric spectroscopy data, we propose that a Grotthuss-like proton hopping mechanism is responsible for the high charge carrier mobility and observed bias-dependent apparent activation energy. The possibility is raised for novel redox reactions to be performed on proteins constrained to specific 3D conformations. This could lead to a deeper understanding of biological processes, such as anhydrobiosis, as well as the development of new biomimetic photovoltaic devices.

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