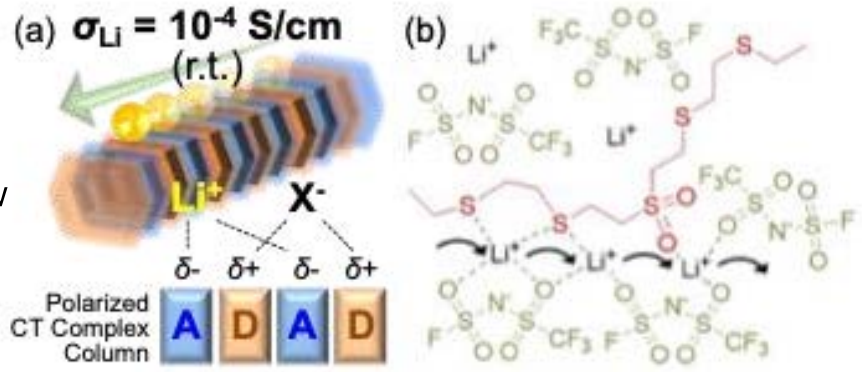
Energy Conversion and Energy Storage

R&D Project Title: Development of organic solid electrolytes based on a new conduction mechanism

Project Leader: Kenichi Oyaizu
Professor, Department of Applied Chemistry, Waseda University

Summary :

The objective of this study is to develop innovative organic Li solid electrolytes that are distinct from conventional Li salt/PEO electrolytes. The aim is to achieve high ionic conductivity and Li-ion transport number, as well as excellent durability and formability, low cost, and low environmental impact.



The conventional limit of lithium ionic conductivity (<10^{-5} S/cm) of organic solid electrolytes will be surpassed through the development of a practical MI that is compatible with functional material design. To elucidate the recently discovered Li ion conductivity of PPE-chloranil CT complexes, a novel conduction model in glassy solids will be devised, diverging from the conventional segmental kinetic model. This will be used (1) to extend Li ion-conductive CT complexes (a), (2) to develop a polymeric solid electrolyte under polymer-in-salt conditions (b), and (3) to demonstrate all-solid-state batteries utilizing these electrolytes.

The accelerated increase in the introduction of renewable energy represents a crucial aspect of future strategies for reducing CO_2 emissions. By 2050, the target year for achieving carbon neutrality, it is estimated that 50% of total electricity demand will be met by renewable energy. The storage of electricity, which is necessary to regulate output, will result in a reduction of ca. 10 million tons of CO_2 emissions. The all-solid-state battery, which plays a role in this process, will contribute to the realization of carbon neutrality through its low-cost, large-scale dissemination based on the high safety and low environmental impact of organic solid electrolytes.