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A new class of fast alkali ion conductor: Inorganic plastic crystals

Batteries operate by polarizing and transferring ions through liquid or molecular solvents. Recent developments have made use of organic cation salts in plastic crystalline states as solvents, in which lithium salts can be dissolved. These lithium salts are known as electrolytes. Unfortunately, they are associated with low conductivity. Other electrolytes have also been explored, but have limited appeal based on factors such as toxicity and poor performance at ambient temperatures. Many electrolytes also cause side reactions, which can release harmful byproducts and decrease performance. There is a pressing need for an effective, long lasting electrolyte able to safely effectively conduct electricity through solvent materials.

Researchers at Arizona State University have developed a new class of electrolyte. This material is highly conductive, matching the conductivity of the best electrolytes currently available on the market. The material contains no organic material, so there is no possibility of side reactions. This electrolyte is conductive when it is in a solid state, and it is not flammable. The material is manufactured from inexpensive, earth-abundant elements and is easy to manufacture. Since this electrolyte is a plastic crystal, it is not brittle in a solid state. Additionally, the electrolyte is stable in the presence of lithium metal and lithium intercalate anodes. This innovation is one of the only available electrolytes that match all the criteria of a good electrolyte.

Potential Applications

- Lithium-ion batteries
- Alkali batteries
- Fuel cells
- Supercapacitors
- Electronics (rugged, personal)

Benefits and Advantages

- Lower Costs – Simple and inexpensive to manufacture from earth-abundant material.
- More Power – provides the highest conductivity.
- Retrofit – Can be used in existing manufacturing processes.
- Performance –
 - Conductive material in the solid state.
 - No possibility for side reactions.
 - Non-brittle solid plastic crystals are able to stay stable in most conditions, including molecular solvents known to encounter stability problems.

For more information about the inventor(s) and their research, please see

[Dr. Charles Angell's directory webpage](#)

[Iolanda Klein's directory webpage](#)