

Investigation of Supercapacitor Design to Improve Energy Storage Technology

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Research Objective: Develop higher energy and power density in electrical energy storage devices (batteries and supercapacitors) to compete with fossil fuels.

Motivation



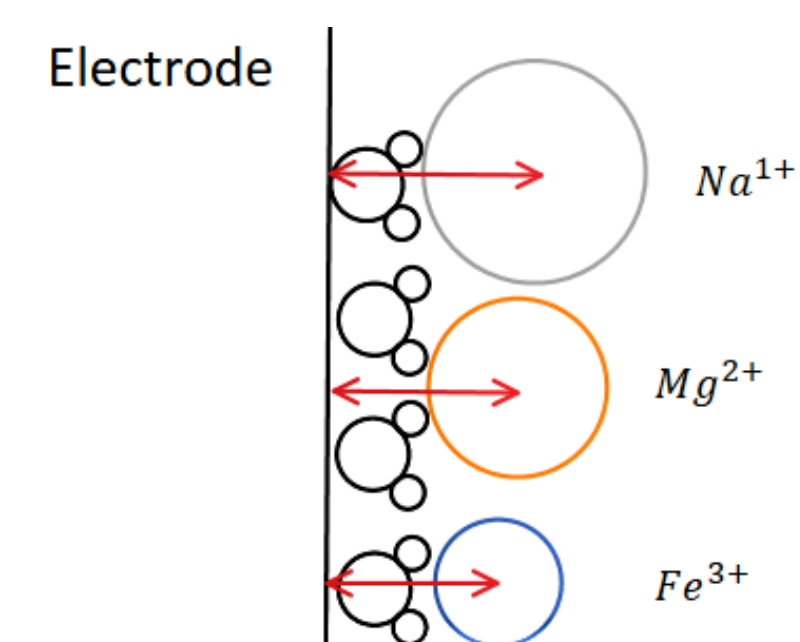
- Provide energy storage for sustainable technology such as electric cars and renewables

IEA World Energy Outlook 2040

- 37% power generation from renewables (23% today)
- 150 million EV on the road (1.2 million today)

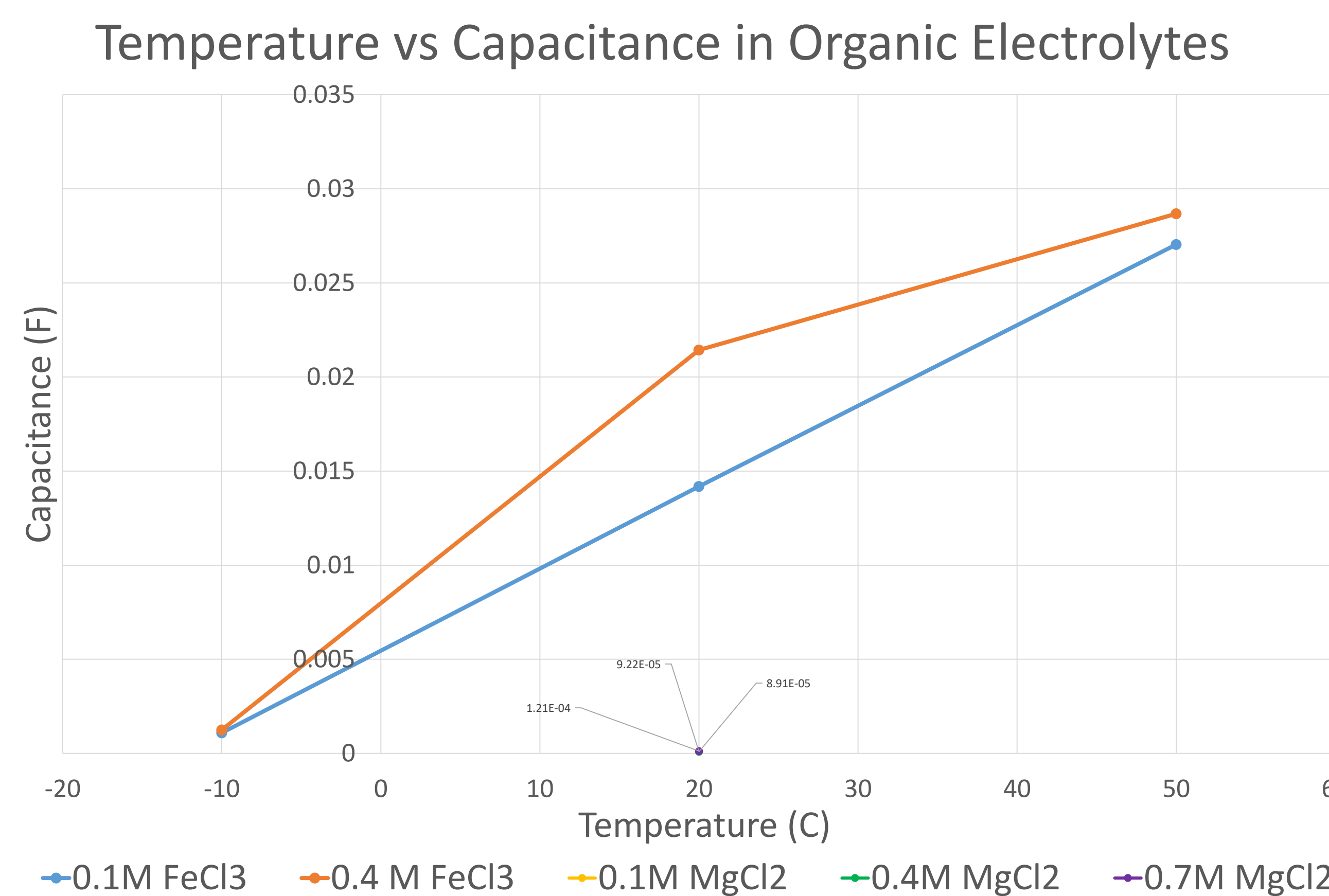
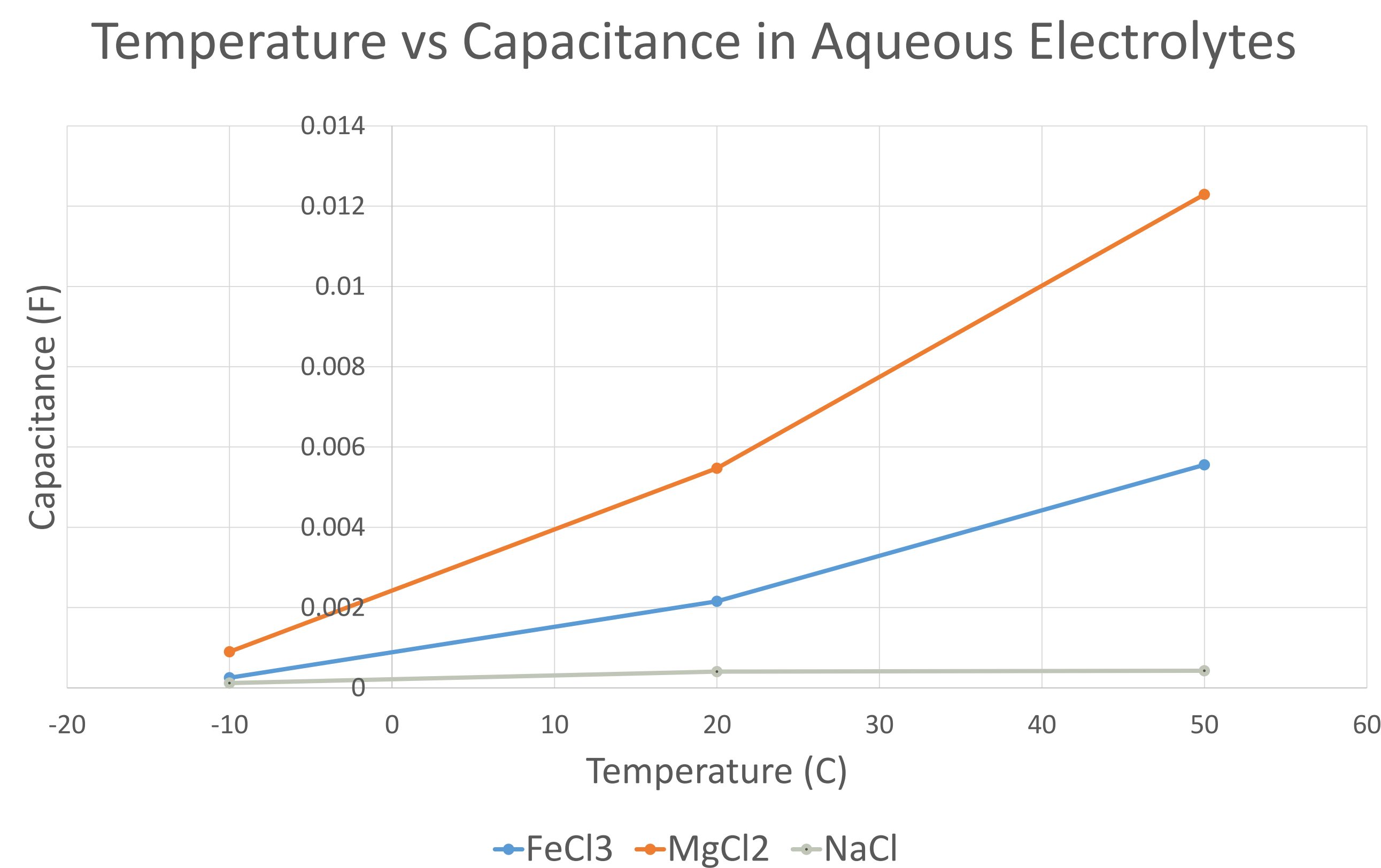
Methodology

- Scrosatti cell testing of $NaCl$, $MgCl_2$, $FeCl_3$ electrolytes in aqueous and organic solutions (Propylene carbonate)
- Increase strength of electric double layer



- Conductivity measurements of electrolyte to reduce internal resistance
- UBA5 battery analyzer testing with new cell geometry and graphene electrodes

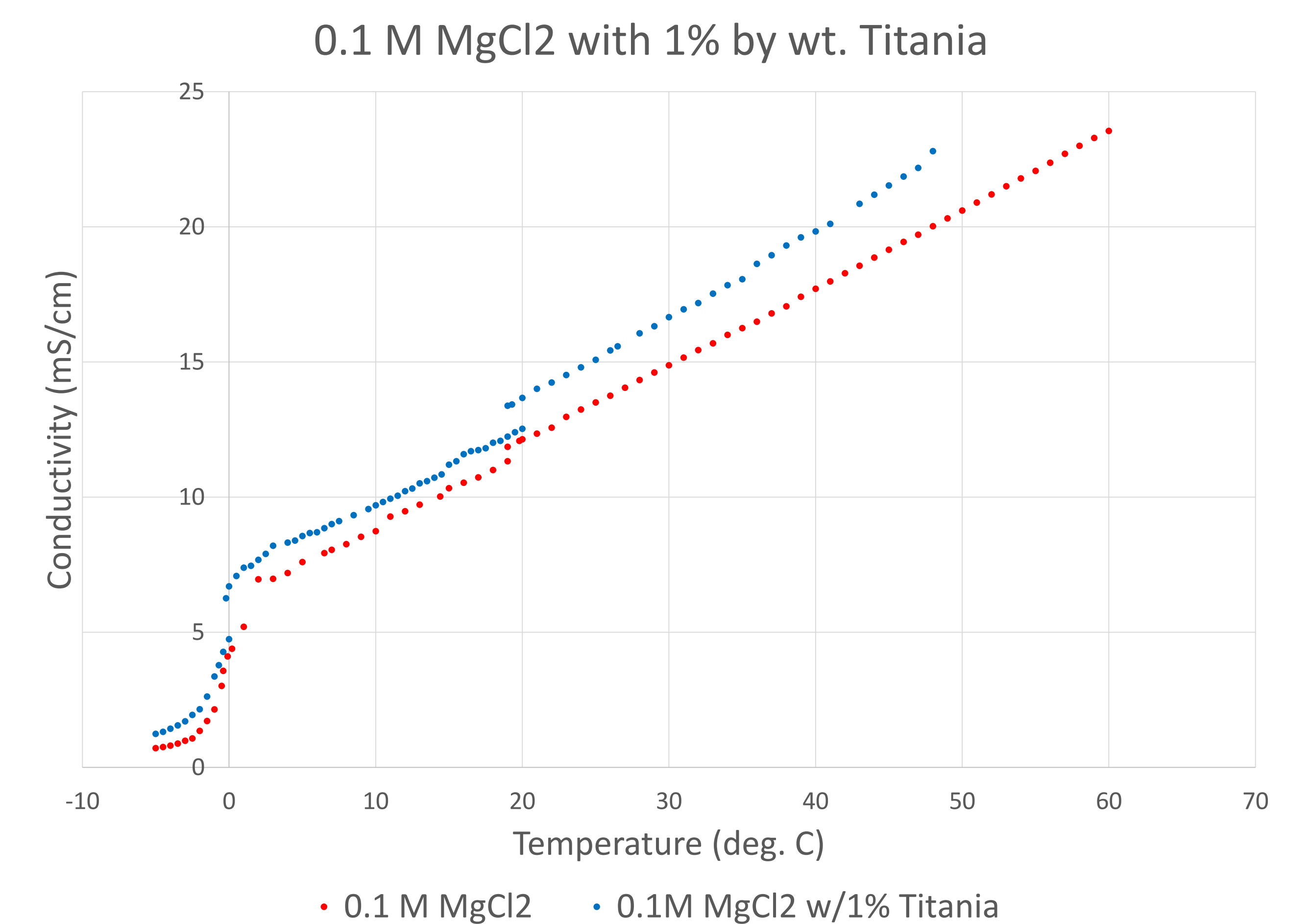
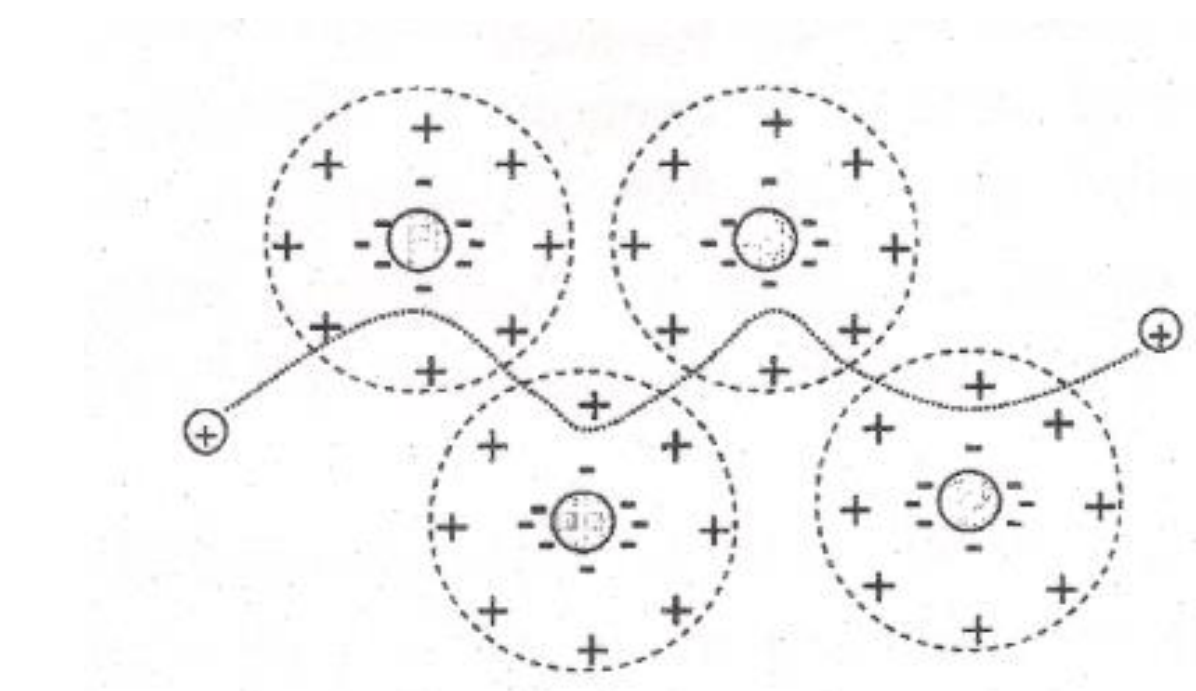
Scrosatti Cell Results



- $FeCl_3$ performed best in organic electrolyte, $MgCl_2$ in aqueous electrolyte
- Capacitance is related to temperature and charge availability in electrolyte

Conductivity Results

- “Space charge” effect leads to higher conductivity with the addition of ceramic nano-particles



Future Work

- Combine learning from coin cell and conductivity results in UBA5 test cells
- Investigate the use of graphene electrodes