

# 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



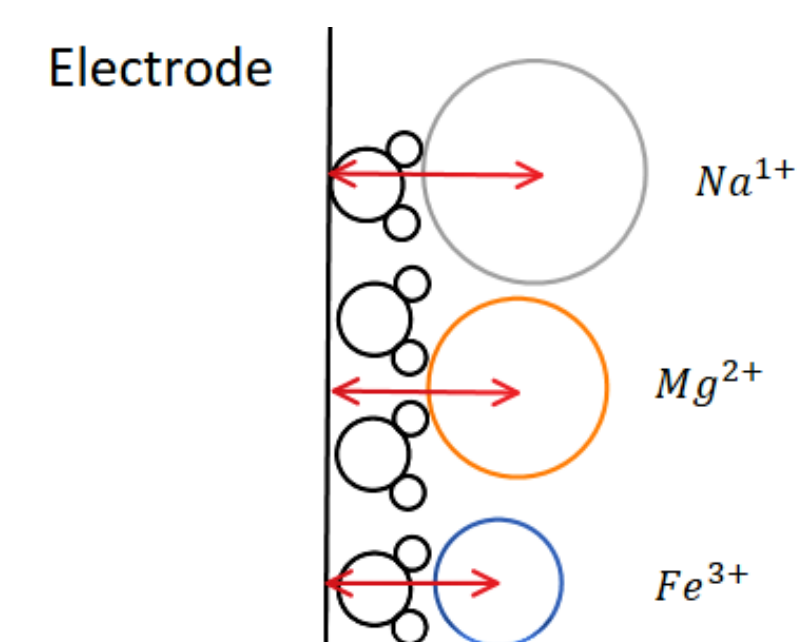
- Provide energy storage for sustainable technology such as electric cars and renewables

## IEA World Energy Outlook 2040

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

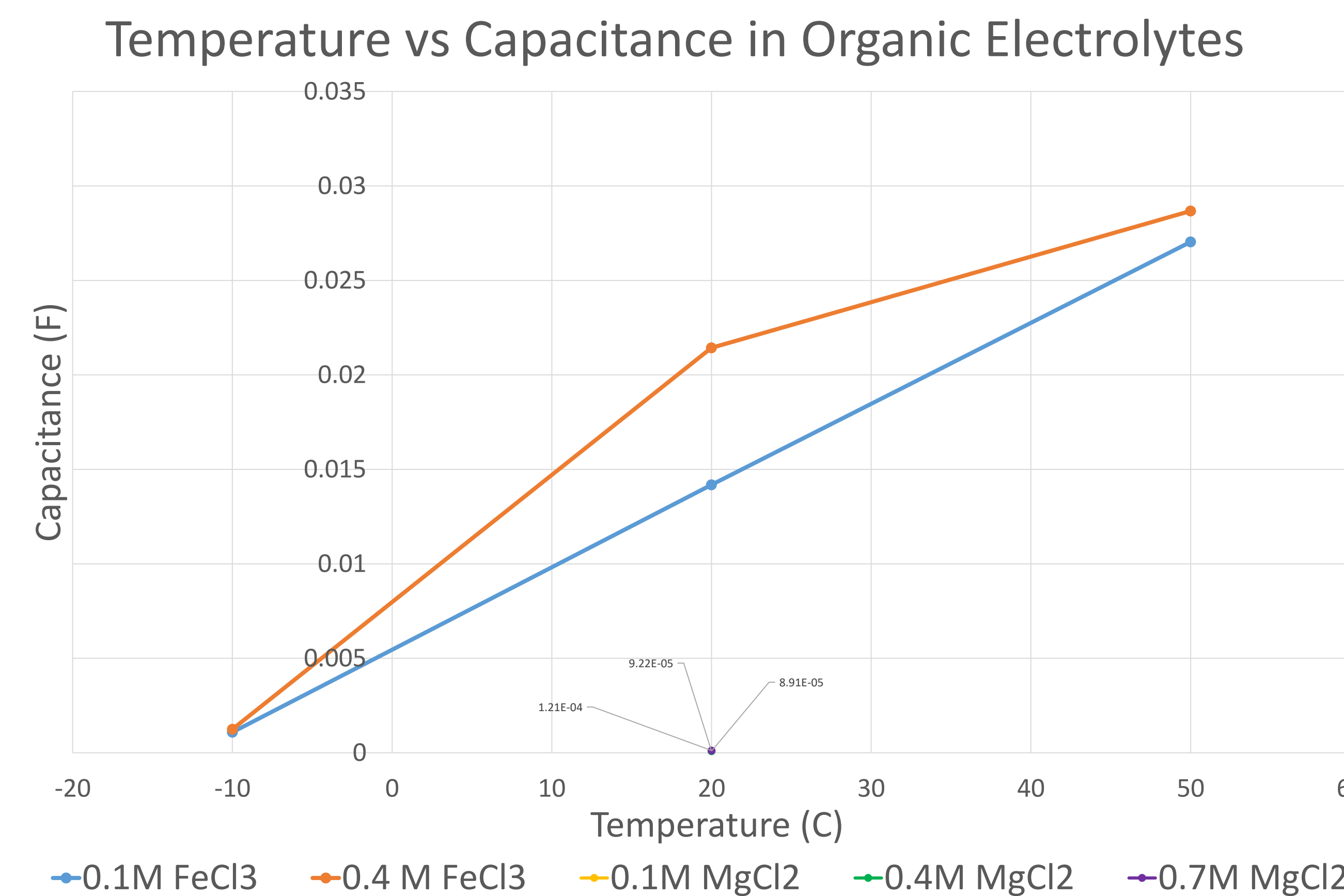
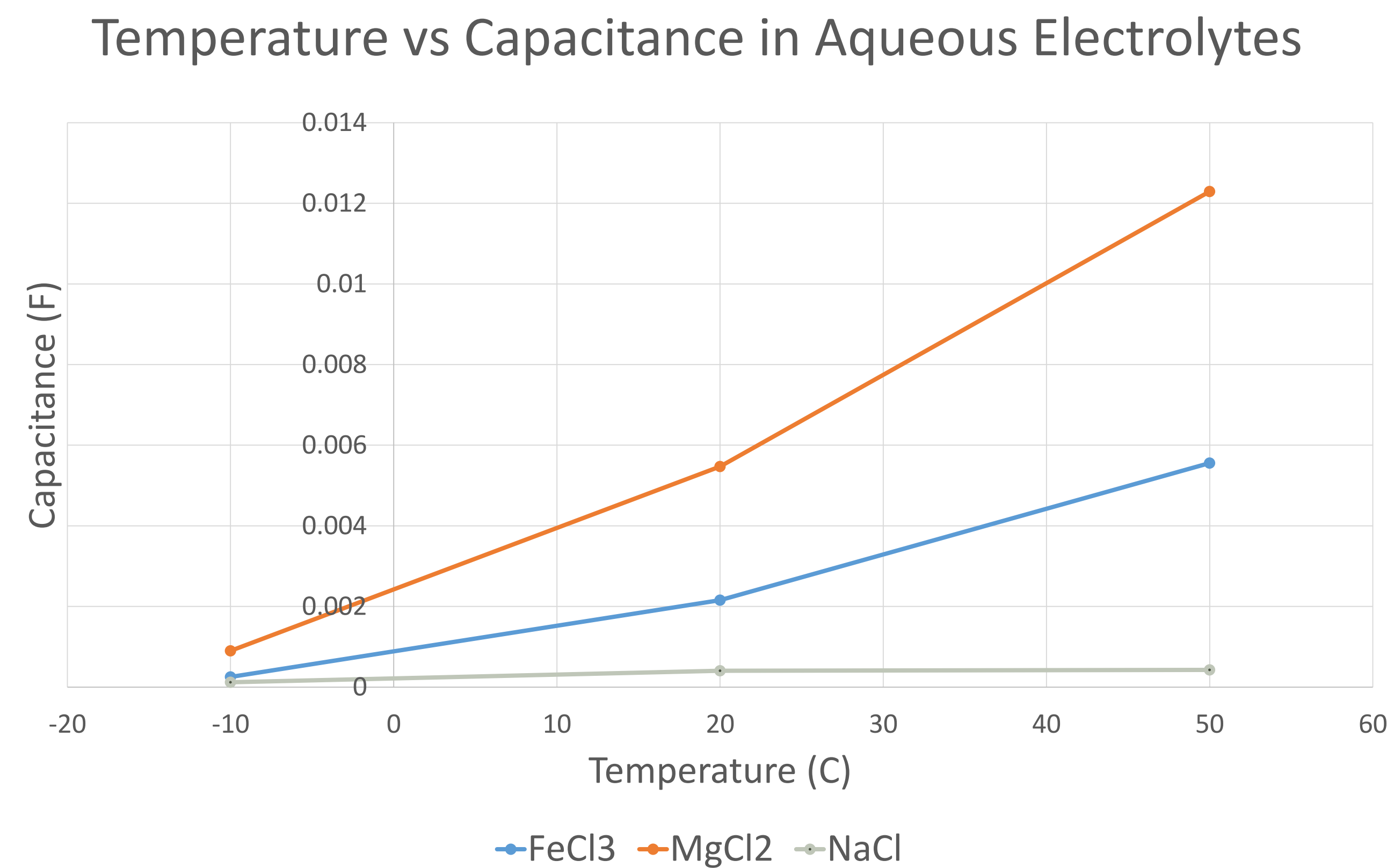
## Methodology

- 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

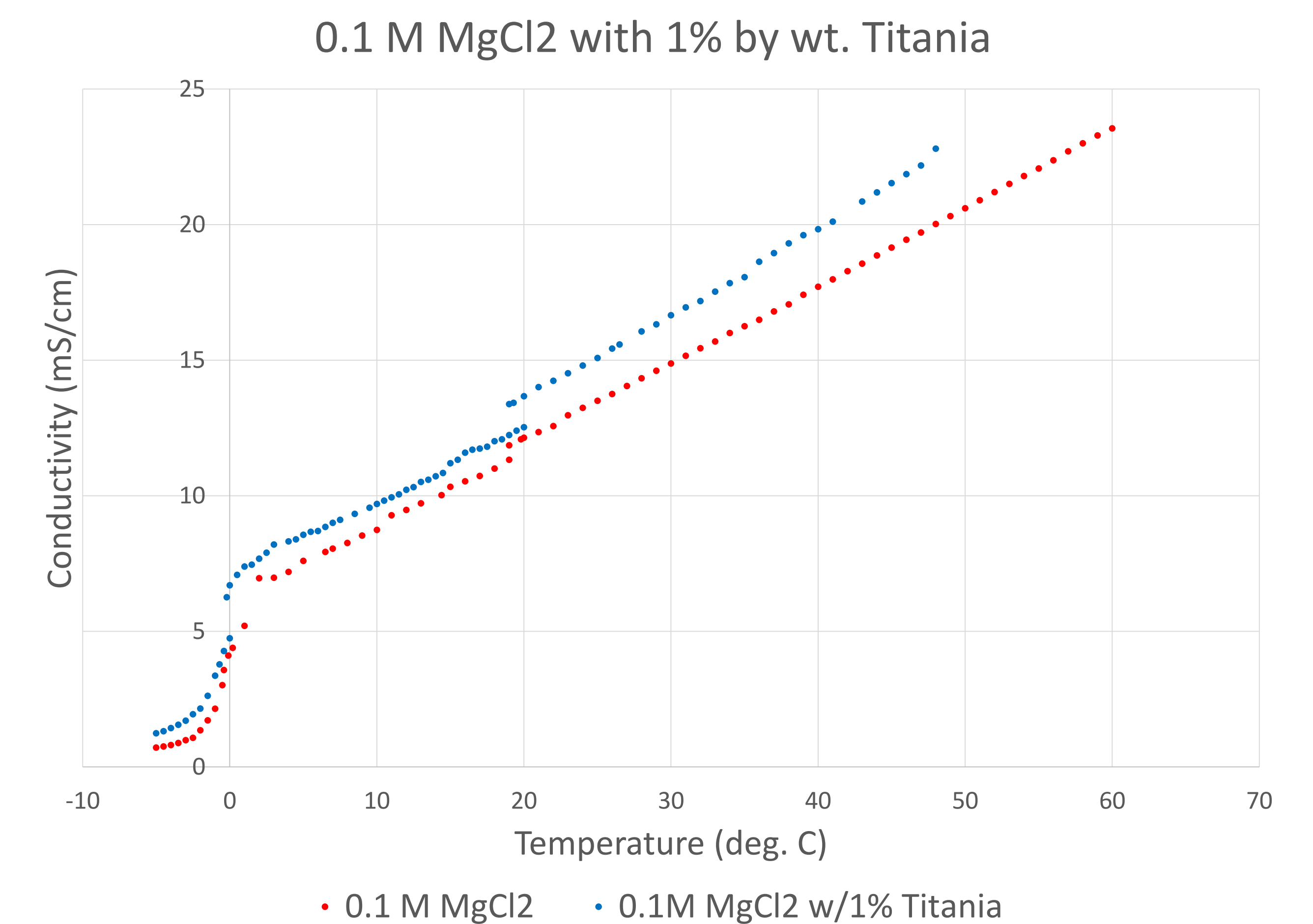
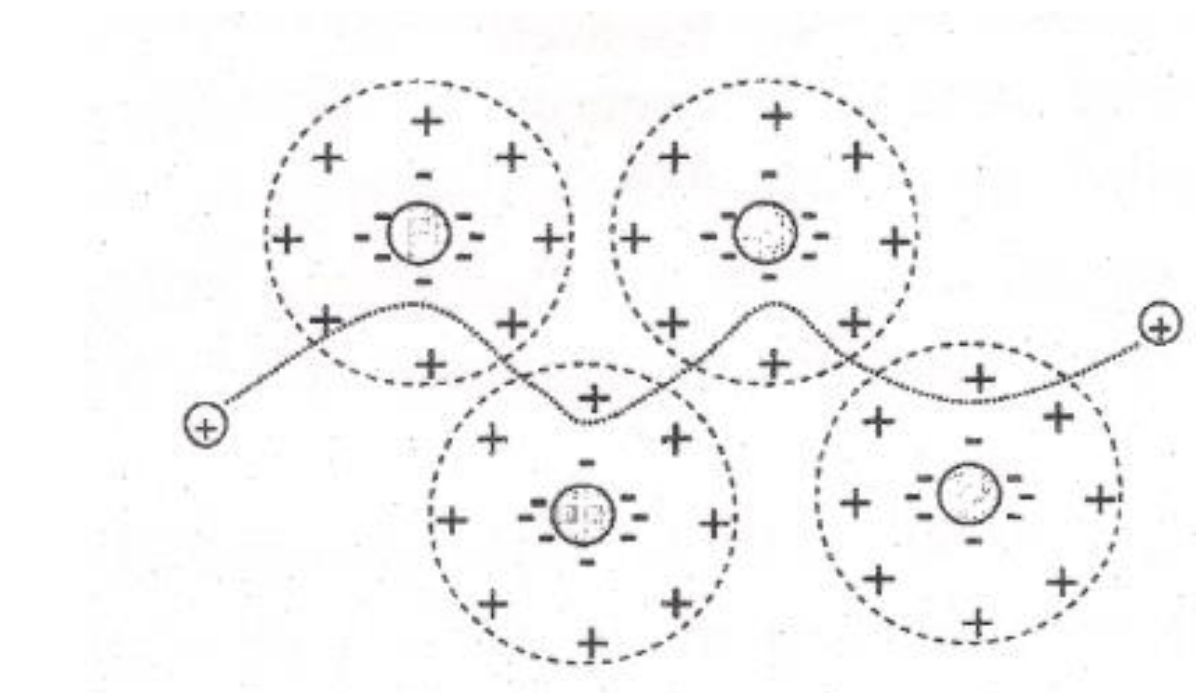
## Scrosatti Cell Results



- $FeCl_3$  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