ABSTRACT
- The interest in additive manufacturing is growing in many applications, including battery production.\cite{1}
- The use of modelling techniques such as DEM helps us predict the behaviour of powder during spreading.\cite{2}
- The calibration will help us understand the powder spreading mechanism to optimise our processes further.

**MOTIVATION**
- Dry battery manufacturing methods such as powder spreading is an excellent alternative to conventional wet slurry casting, eliminating the use of toxic solvents and reduces costs.
- Experimental investigations are crucial to characterise and calibrate the relevant input parameters for the DEM model of powder spreading.

**PROJECT AIMS TO:**
1. Provide an extensive characterisation on NMC622 and the effects of mechanofusion and carbon additives.
2. Calibrate the parameters required for the DEM simulation of NMC622.

**METHODS**

**Powder Preparation**
- NMC622
- Pre-Programmed by FT4 Rheometer

**Powder Characterisation**
- Static angle of repose (AOR) measured experimentally

**DEM Modelling of the static AOR experiment**
- Unknown input parameters (eg. rolling friction, surface energy) initially estimated
- No optimise input parameters using Design of Simulations (DoS)

**DEM Simulation**
- Assessed AOR (in DEM) = Static AOR (in experiment)?
- Yes: Calibrated Parameters Proceed to the DEM model of powder spreading
- Yes

**FLOWABILITY: f, SPECIFIC ENERGY & BFE**
- Low cohesion leads to better unconfined flow and confined flow
- Low specific BFE = Good confined flow
- Low specific energy = Good unconfined flow
- The flowability of the powder samples is highly dependent on the consolidation stress applied.
- Generally observing improved flow at higher consolidation stresses for all samples.

What improves the flowability of powder?
- High specific energy (no ageing)
- Mechanofused addition of C65

**STATIC ANGLE OF REPOSE (AOR) CALIBRATION**
- Sample 3 has a much higher AOR than the rest
- Aged sample has higher moisture content, which increases cohesivity
- AOR has low sensitivity towards the effects of mechanofusion and C65 additives despite observing obvious changes in flowability.

**CONCLUSION**
- Based on the characterisation, a DEM model was successfully calibrated for Sample 1, with the following finalised input parameters:
  - Sliding friction (particle – surface): 0.3
  - Surface energy (between particles): 1.5 mJ/m²
  - Surface energy (on current collector): 1 mJ/m²
- The effects of C65 addition and ageing produces a change in flowability based on the FT4 measurements, but subtle changes in the static AOR experiment.

**FUTURE PLANS**
1. Calibrating all four samples on DEM will require the assessment of more than one bulk property.
   - Construct a DEM model of the wall friction and uniaxial compression tests compare with the existing experimental data obtained
2. Investigate the effects of increasing the percentage of C65 on the flowability of NMC622.
   - Identify the optimum amount of C65 to achieve desired flow
3. Experimentally obtain the input parameters for DEM to reduce the DoS matrix.

**REFERENCES**
\cite{1}

**BIOGRAPHY**
Eunice is currently studying Mechanical Engineering at Imperial College London. She is interested in exploring the ever-growing battery industry. In the future, she aspires to work in impactful research that would lead towards the sustainable future of batteries.