Introduction to the Materials Science of

Rechargeable Batteries

Week 3: Tortuosity and Porosity in Battery Materials
Lecture 3.2: **Effect of Processing on Tortuosity**

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Combined Coarse and Fine Tortuosity

\[ \tau_T = \tau_0 \tau_v \]

\[ \tau_0 = \frac{1}{\epsilon^{1/2}} \]

\[ \tau = \frac{1}{(\epsilon \nu)^{1/2}} \]

Electrode Microstructure

\[ \text{LiNi}_{1/3}\text{Mn}_{1/3}\text{Co}_{1/3}\text{O}_2 \]

Effect of Processing Conditions

**Filler Weight Fraction**

**Electrode Compaction**

Effect on Charge Capacity

Tortuosity

Inactive Filler wt%

Compaction Stress (kbar)

Mesoscale Tortuosity

\[ \varepsilon_T = \varepsilon_\circ \varepsilon_\nu \]

\[ \tau_T = \tau_\circ \tau_\nu \]
Effect of Processing Conditions

\[ \tau = \epsilon^{-\frac{1}{2}} \]

Effect of Spatial Inhomogeneities

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Porosity vs. Tortuosity

Matching particle packing inhomogeneities

Particle Size Effects and Inhomogeneities