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<td><strong>Citation</strong></td>
<td>Loke, E. S. (2010, March). Energy storage: nanostructured manganese dioxide for supercapacitor application. Presented at Discover URECA @ NTU poster exhibition and competition, Nanyang Technological University, Singapore.</td>
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<tr>
<td><strong>Date</strong></td>
<td>2010</td>
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<td><strong>URL</strong></td>
<td><a href="http://hdl.handle.net/10220/9036">http://hdl.handle.net/10220/9036</a></td>
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Energy Storage: Nanostructured Manganese Dioxide for Supercapacitor Application

1. Introduction
Supercapacitors are energy storage devices that use carbon, conductive polymers and transition metal oxides such as MnO₂ as electrode material. They are different from traditional capacitors due to their storage mechanism and the ability to store much more energy.

2. Goal
To improve the specific capacitance of manganese dioxide by maximizing the surface area of the electrode.

3. Methodology
Tri-block copolymer, P123, used as soft template

- P123 dissolves in water and form micelles
- Add Mn²⁺ ions which surround the micelles
- Mn²⁺ oxidizes to MnO₂ by KMnO₄
- MnO₂ precipitated
- Remove P123 by washing with water
- Mesoporous MnO₂ obtained

4. Results
SEM shows hierarchical nano-rod morphology
XRD shows α-MnO₂ phase
CV curves at various scan speed close to rectangular shape, shows relatively ideal pseudo-capacitive behavior

5. Conclusion
We have synthesized mesoporous α-MnO₂ using P123 and achieved a maximum specific capacitance of 355 F/g. More work will be done to optimize the performance of our electrode material.