

Recent Progress in Mesoporous Titania Materials

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STAM Best Paper Award 2014



Recent progress in mesoporous titania materials: adjusting morphology for innovative applications

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Mesoporous Titania Materials (MTMs): Adjusting Morphology



MTMs Advantages:

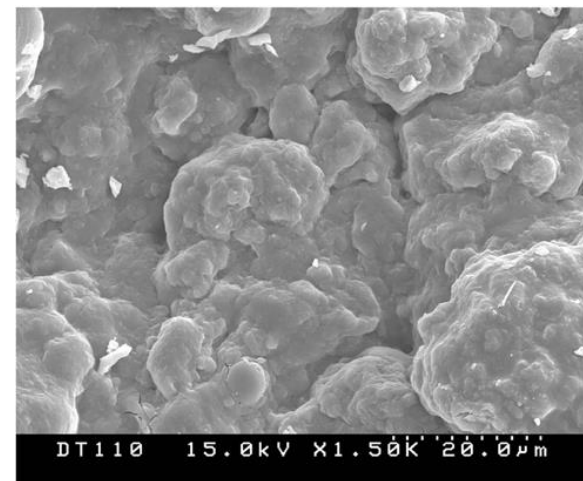
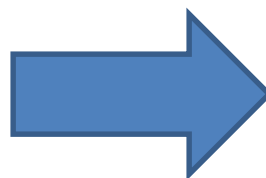
- High surface area
- Tunable pore size
- Large pore volume
- Ordered porous structure

MTMs Advantages:

- High density of reactive sites
- Efficient mass transport
- Large loading of “active” molecules

MTMs Bulk

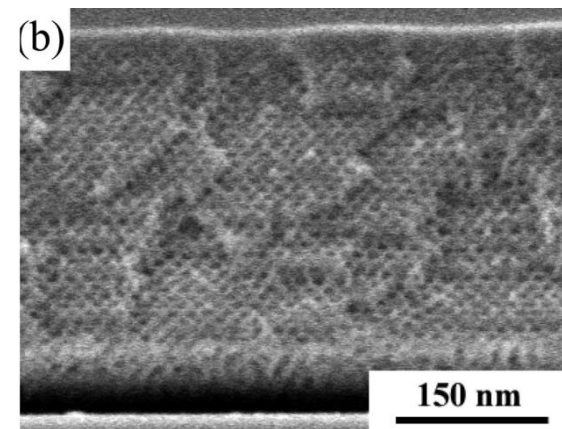
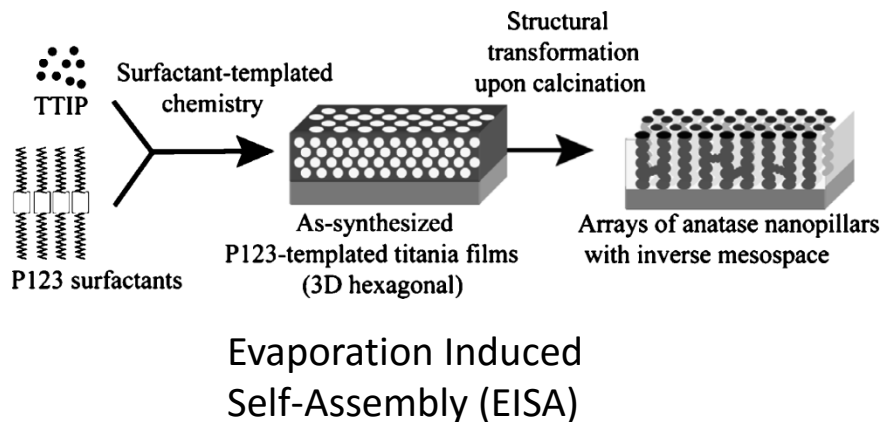
Surfactant-templated
condensation method in the
presence of Ti source



Mesoporous Titania Materials (MTMs): Adjusting Morphology



MTMs Films

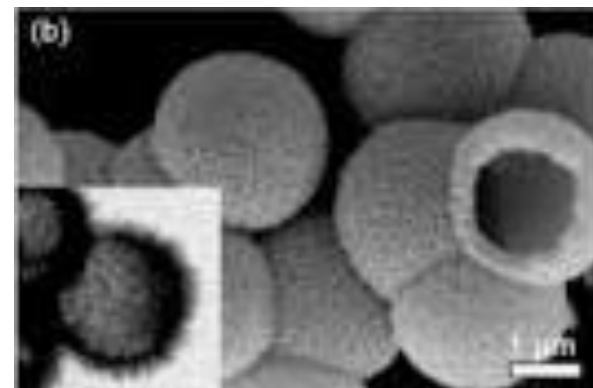
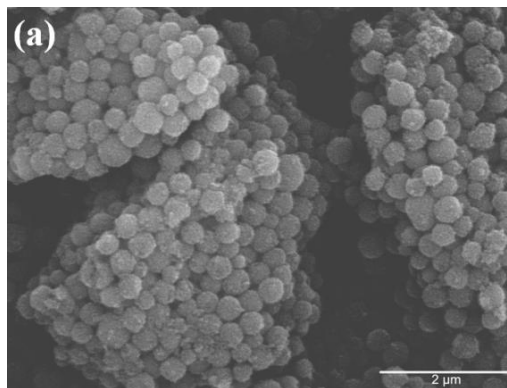


J. Am. Chem. Soc. **2006**, 128, 4544-4545

Mesoporous Titania Nanoparticles (MTNs)

Methods:

- Surfactant-templated Sol-gel
- Solvothermal/Hydrothermal
- Ultrasonication
- Spray-drying (EISA)



Chem. Commun. **2011**, 47, 5232/J. Am. Chem. Soc. **2007**, 129, 8406

Mesoporous Titania Materials (MTMs): Applications



Photocatalysis

MTMs



Light absorption
(electrons)



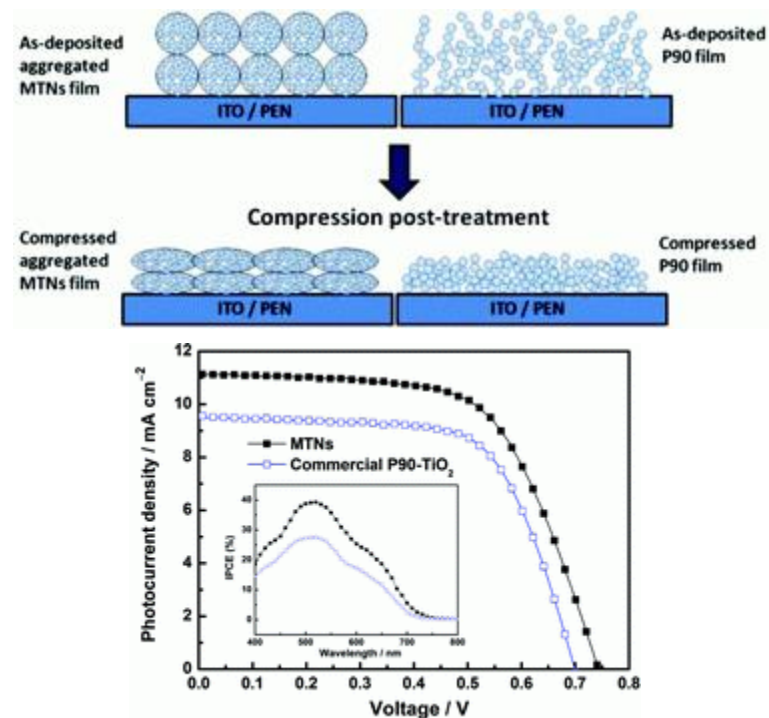
Reactive Oxygen
Species (ROS):
 $\cdot\text{OH}$, O_2^- , H_2O_2

Oxidation of pollutants/Water treatment
Water splitting to generate hydrogen

Photovoltaic

TiO_2 is a major component of DSSCs
Morphology, surface area and pore
volume
Dye/Light absorption in DSSCs

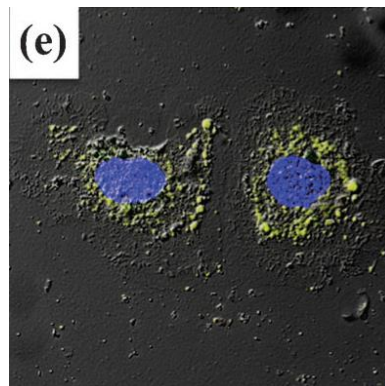
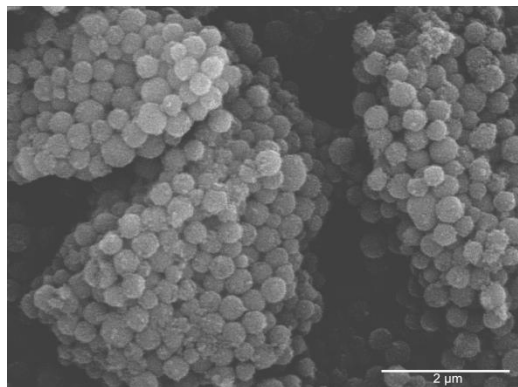
Dye-sensitized solar cells (DSSCs)



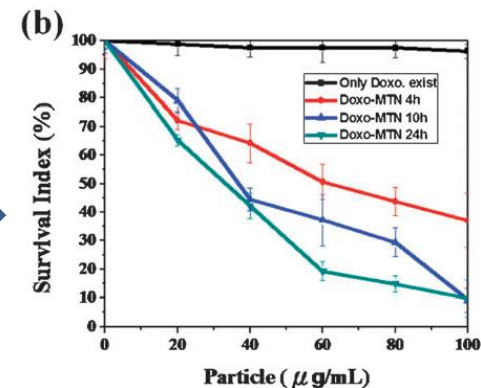
Mesoporous Titania Materials (MTNs): Biomedical Applications



Drug Delivery

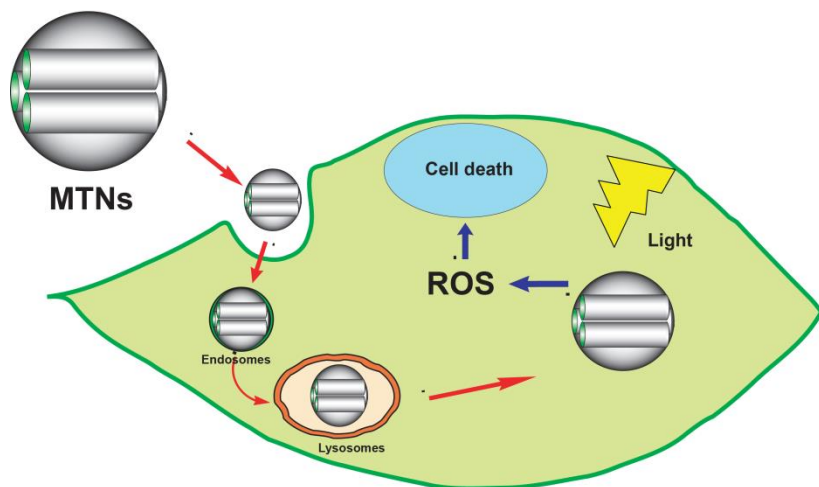


Doxorubicin



Chem. Commun. **2011**, 47, 5232

Photodynamic Therapy



Conclusions!

Acknowledgements



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Thank you very much!

ありがとうございます