Ternary Magnetic Photocatalysts

Synthesis of core/shell/shell nanostructures for a water purification system.

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Research Experience for Undergraduates - 2013

Clean Water

3.4 million people die each year from water related diseases.

780 million people lack access to clean water.

Facts from :

http://water.org/water-crisis/water-facts/water/

Water Purification Methods

- Physical: filtration, sedimentation, distillation
- Biological: slow sand filters, biologically active carbon
- Chemical: flocculation, chlorination, UV treatment

Our Proposed Solution

Make nanoparticles that break down organic contaminants in water.

Design sustainable water purification system.

Overview

Ternary Magnetic Photocatalysts:

- Concept
- Methods
- Results
- Future directions

Photocatalysis

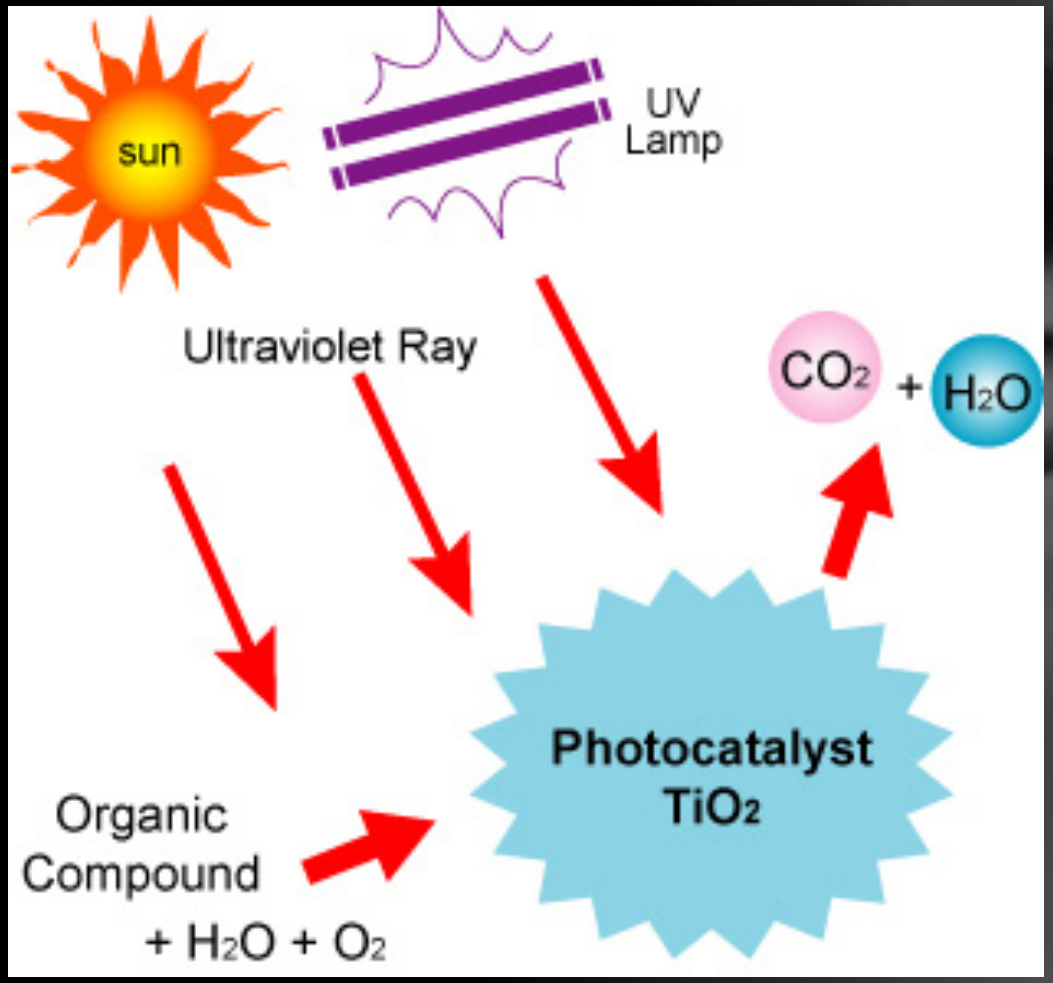
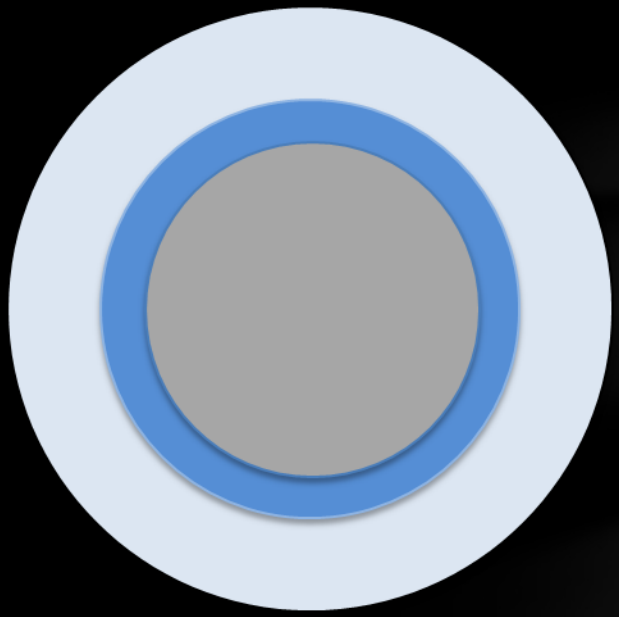


Image from Bioecotech:
http://bioecotech.com/Photo/Product%20-%20Ebuzz/photocatalytic.jpg

Basic Concept



Shell: TiO_2 — Photocatalyst

Intermediate: SiO_2 — Protects Core

Core: Fe_3O_4 — Magnetic

Methods

Synthesis:

- Solvothermal core synthesis
- Sol-Gel silicon oxide coating
- Sol-Gel titanium oxide coating

Final Product:

Crystallized surface by calcination

Characterization and Analysis

SEM/TEM

- Elemental confirmation by EDX

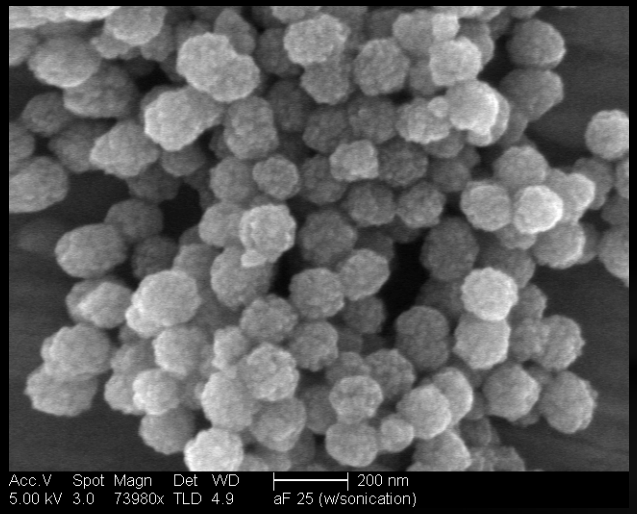
Raman Spectroscopy

- Anatase phase confirmation

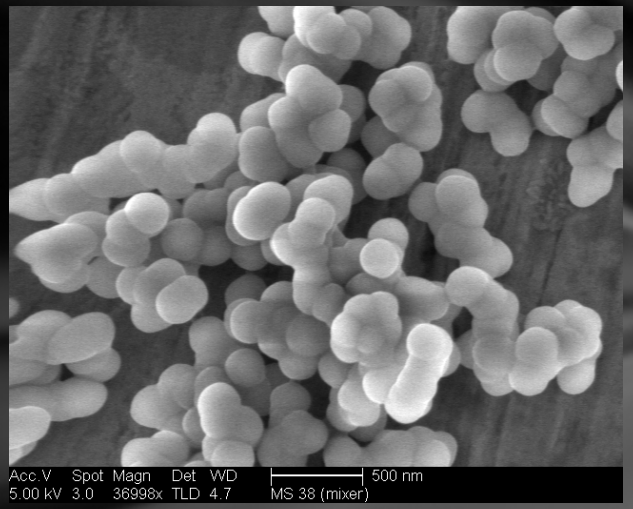
UV/Vis Spectrophotometry

- Degradation studies

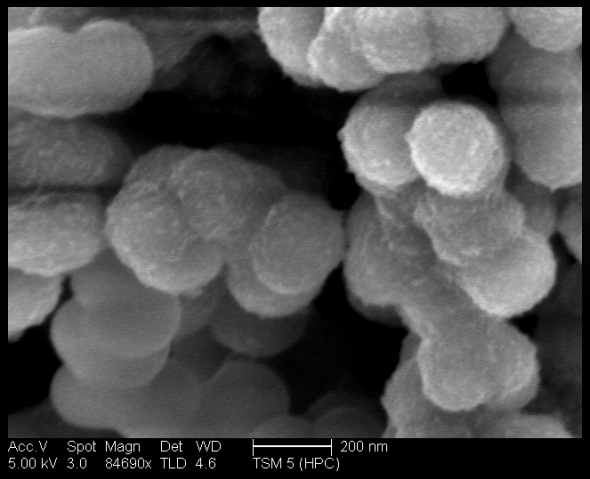
SEM Images



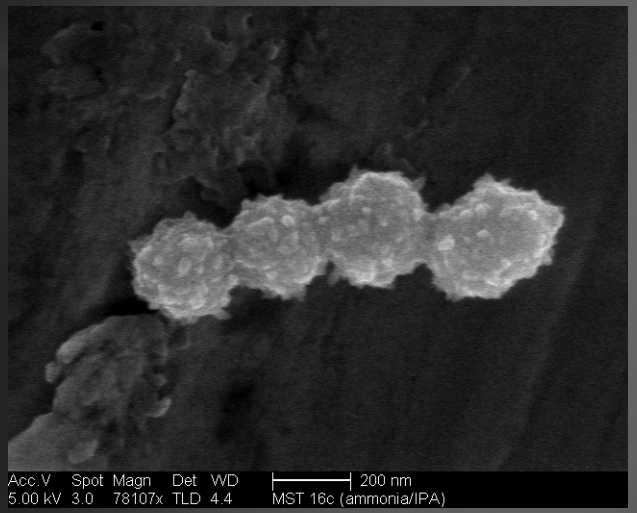
Core



Core/Shell

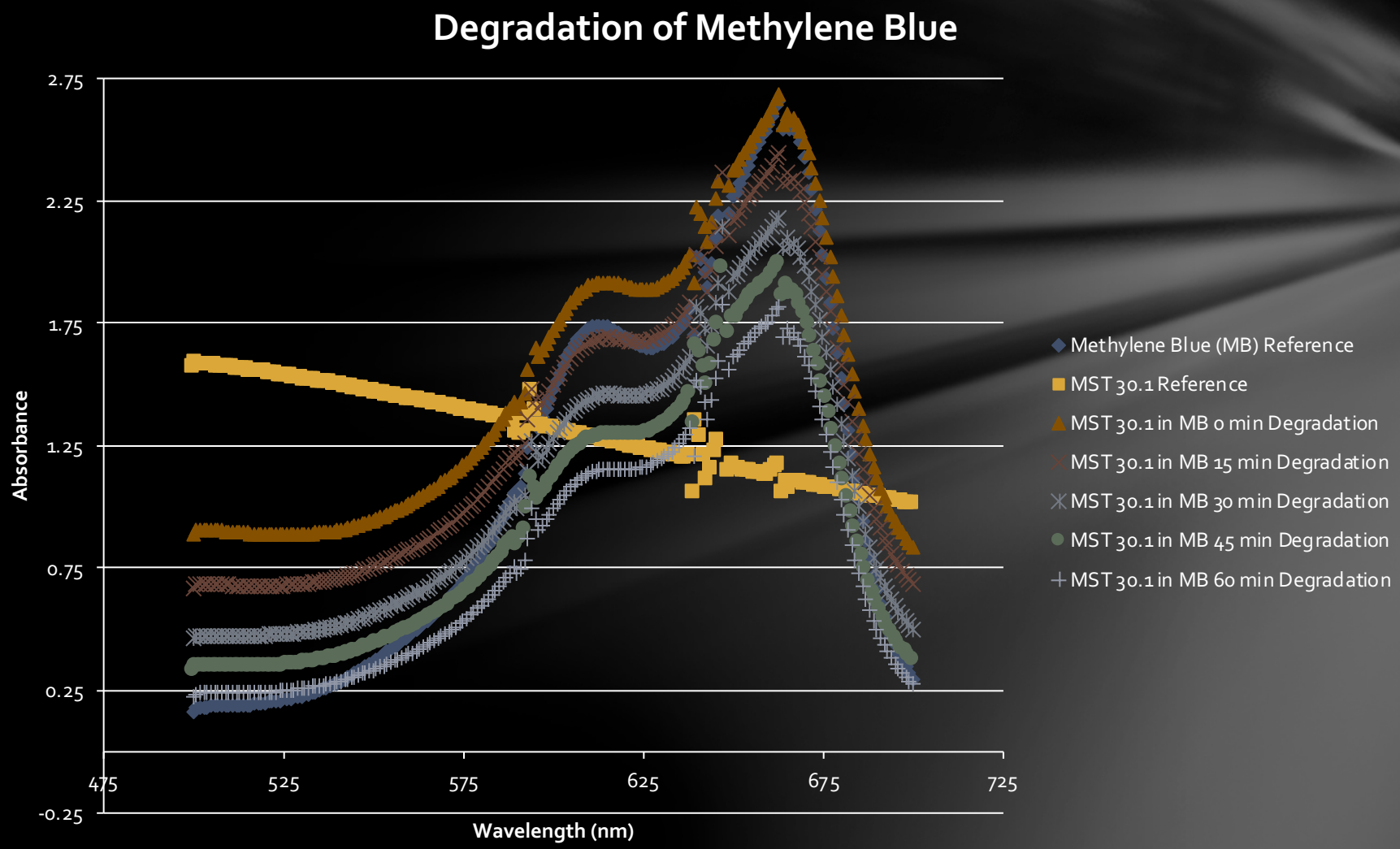


Core/Shell/Shell



Crystallized Ternary Particles

Degradation Studies



Future Directions

Layer optimization

Degradation experiments

Further characterization:

- Crystal structure analysis
- Magnetic studies
- Toxicity in biological systems

Conclusion outline

- Designed sustainable water purification system
- Synthesized ternary magnetic photocatalysts
- Successfully obtained degradation results

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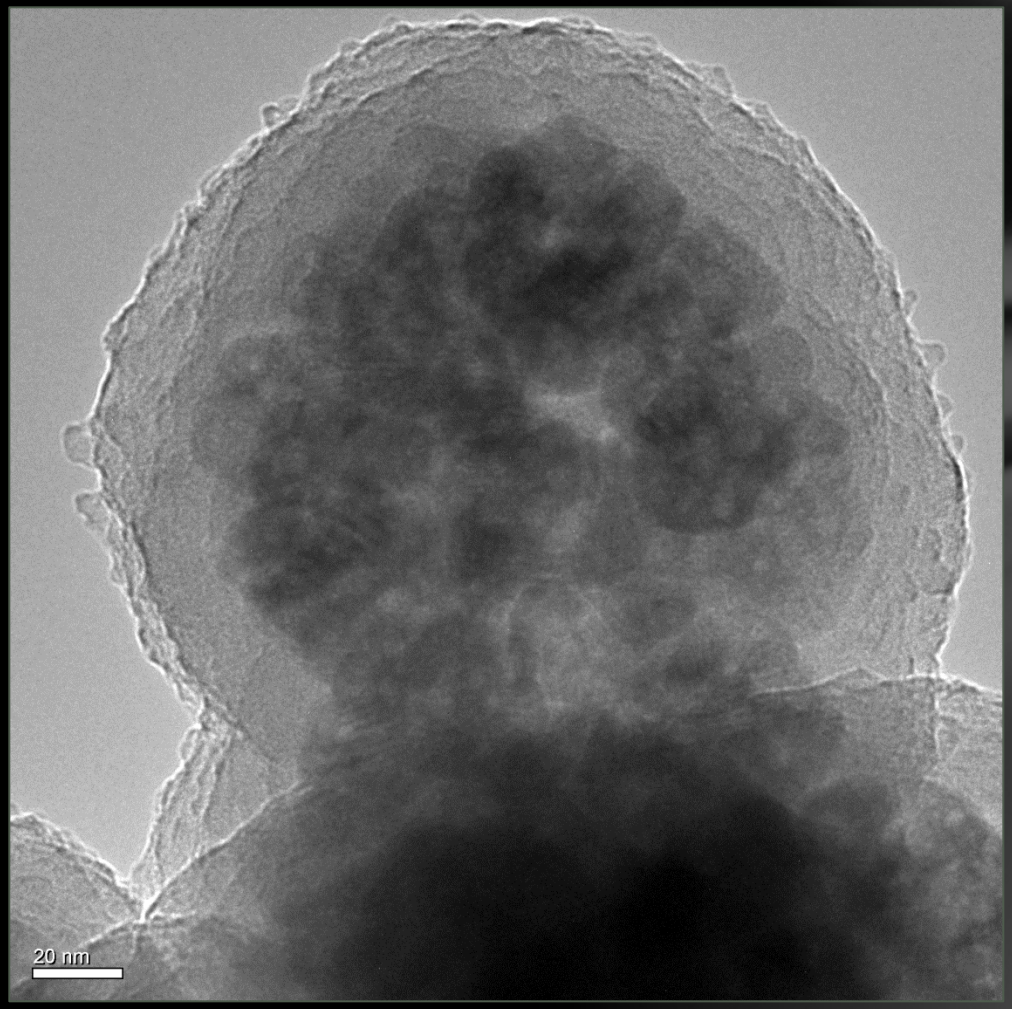
Water facts from water.org:

http://water.org/water-crisis/water-facts/water/

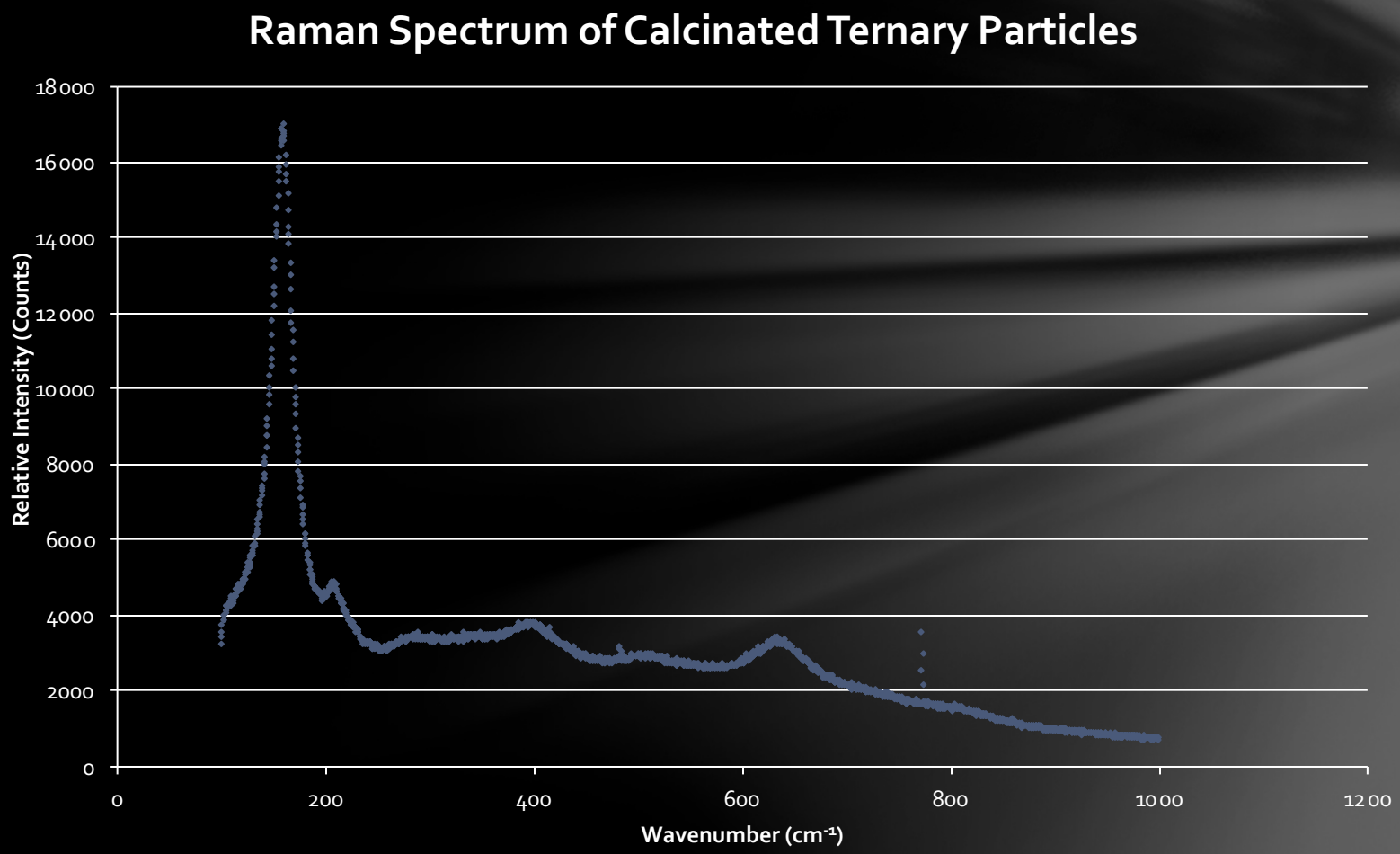
Photocatalysis image from BioEcotech Official Website:

http://bioecotech.com/Photo/Product%20-%20Ebuzz/photocatalytic.jpg

Questions?



Raman Data


Raman Spectrum of Calcinated Ternary Particles
Relative Intensity (Counts)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
200
400
600
800
1000
1200
Wavenumber (cm-1)