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Investigation of Luminescent Properties of Carbon Nanodot Superstructures Assembled via Emulsion-Templated Assembly

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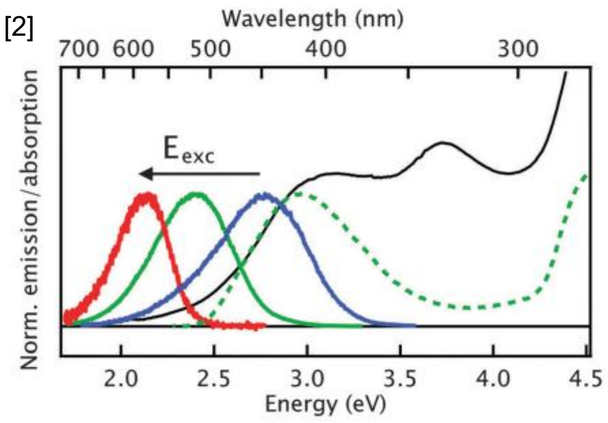
INTRODUCTION & AIM

❖ **A superstructure** is an ordered assembly of nanoscale building blocks into a larger periodic structure, exhibiting new optical properties. [1]

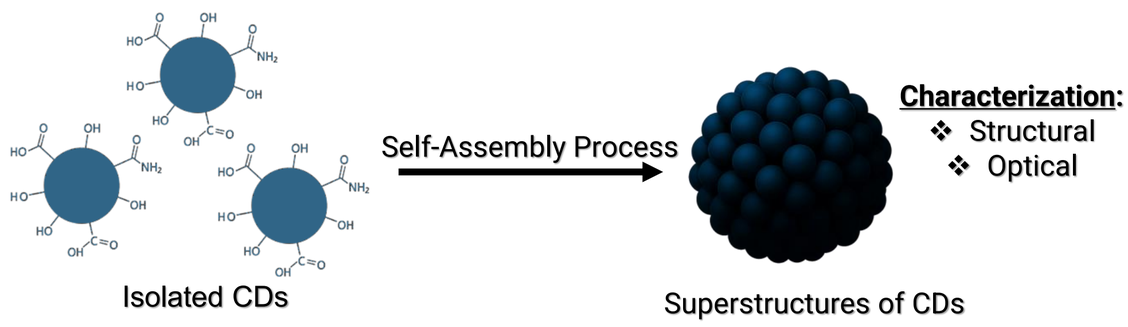
❖ Characteristics of Carbon Nanodots (CDs)

[2]



- ✓ Carbon-based materials
- ✓ Biocompatibility
- ✓ Nanoscale (2 to 10nm)
- ✓ Tunable fluorescence
- ✓ Low-cost, eco-friendly synthesis
- ✓ Applications : Sensing, Bioimaging, Drug delivery, Photocatalysis…
- ✗ Emission quenched with aggregation

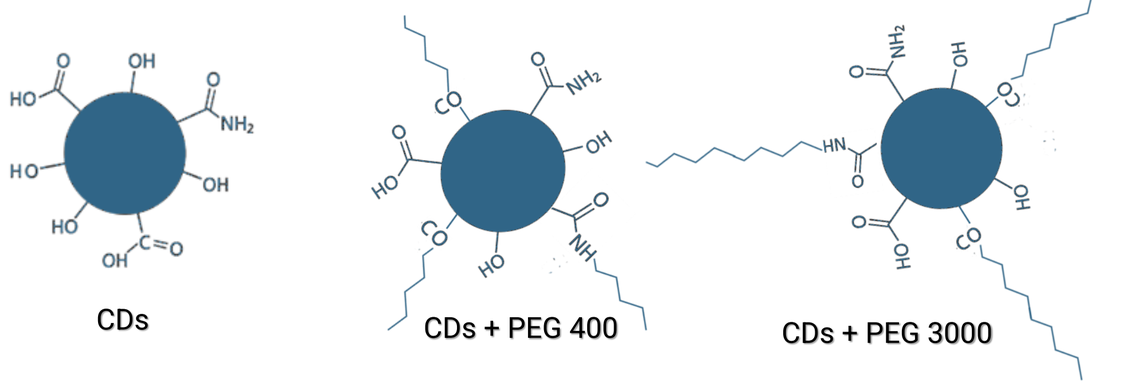
❖ Aim:



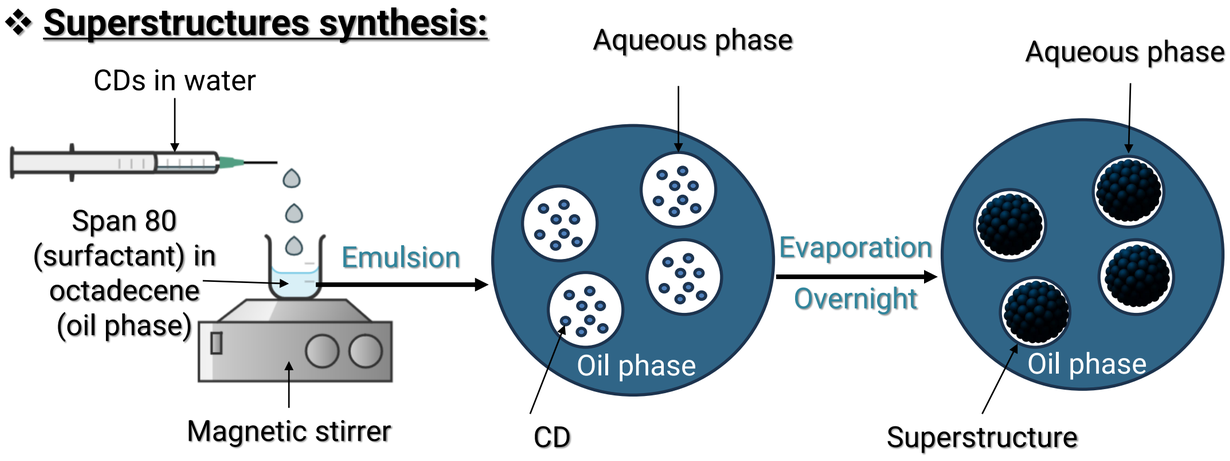
Characterization:
- ❖ Structural
- ❖ Optical

METHOD

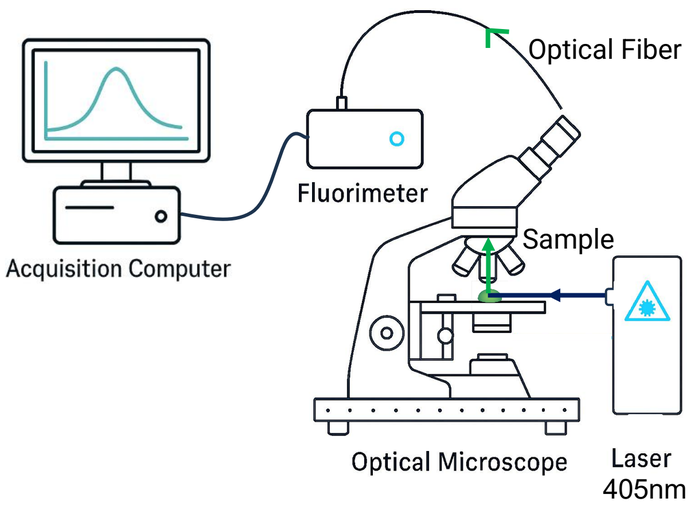
❖ Three types of "building blocks":



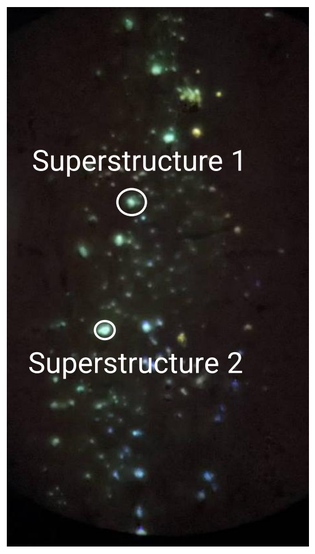
❖ Superstructures synthesis:



❖ Optical characterization set up:



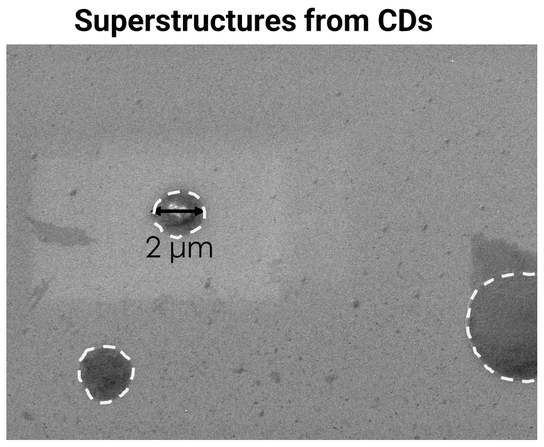
Under 405 nm excitation



RESULTS & DISCUSSION

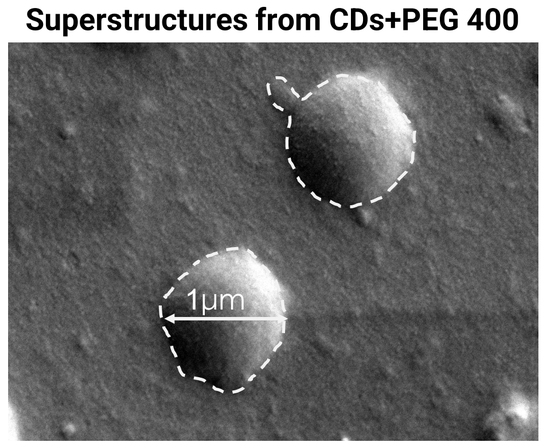
❖ Structural Characterization: SEM Measurements

Superstructures from CDs



❖ Less regular
❖ Not well-defined shape
❖ Very broad size distribution

Superstructures from CDs+PEG 400

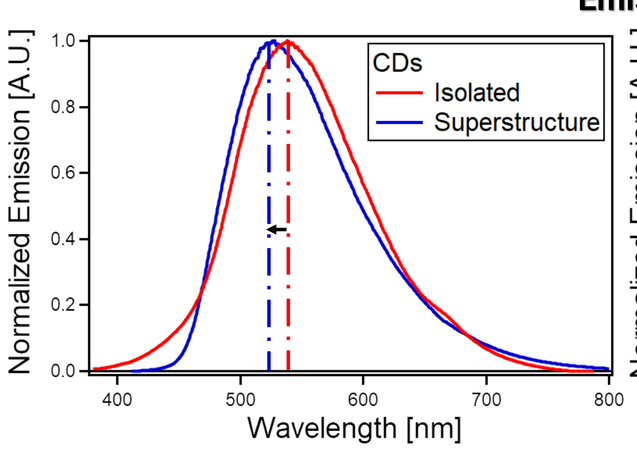


❖ Semi-spherical shape: 3D superstructures!
❖ Narrow size distribution

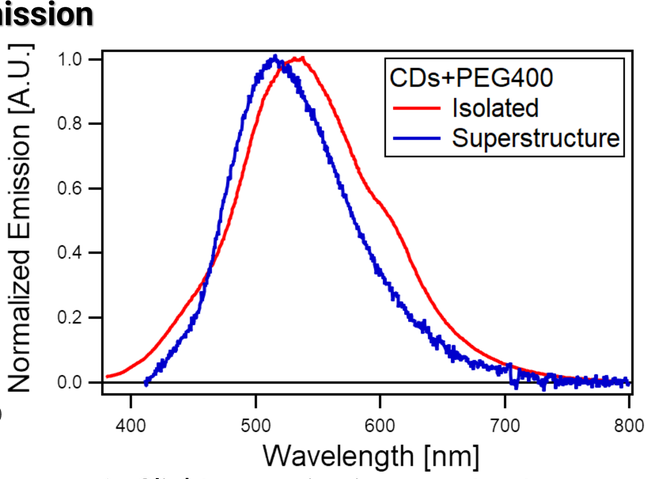
PEG seems to favor regular self-assembly

❖ Optical characterization

Emission



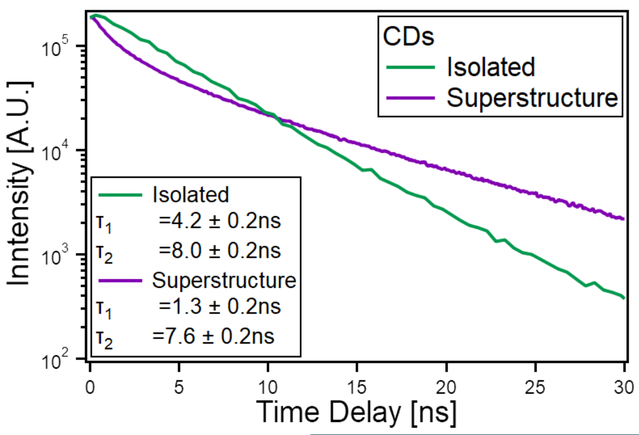
❖ Superstructure emission blueshifted

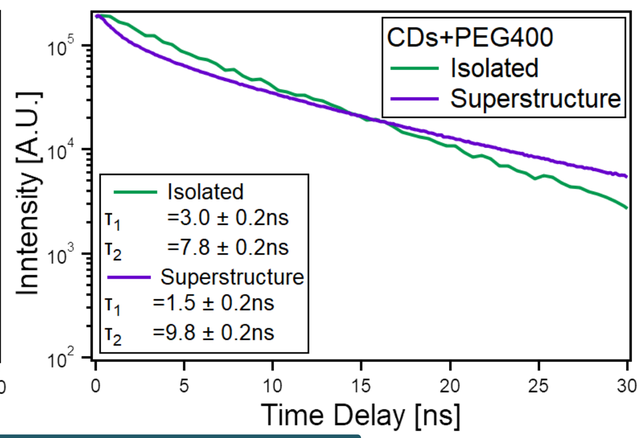


❖ Slight narrowing in superstructure blueshifting

Superstructures are highly emissive both with and without PEG400

Kinetics





Longer lifetime for superstructures

CONCLUSION

- ✓ Synthesis of luminescent 3D CDs superstructures
- ✓ Changes in photoluminescence properties:
  - ❖ Blueshift in emission
  - ❖ Longer lifetime

FUTURE WORK / REFERENCES

- ❖ Investigation of the photostability of the superstructures
- ❖ Test with a longer polymer : PEG 3000
  - ❖ Structural characterization (SEM)
  - ❖ Photoluminescence characterization (Emission and kinetics)

References:

[1]Liu et al., Matter 4, 927–941
[2] J. Mater. Chem. C, 2016, 4, 2598