**Abstract**

- Photoluminescent MoS\(_2\) QDs interspersed on MoS\(_2\) nanosheets (MoS\(_2\) QDNS) were synthesized by the hydrothermal reaction of MoS\(_2\) powder and NaOH.
- Transmission electron microscopy (TEM), Atomic force microscopy (AFM) and Raman spectroscopic studies reveal the formation of mono and bilayered sheets of MoS\(_2\) along with QDs with size 2-4 nm.
- Emission from three different regions (blue, green and near red) are surmised to be arise from smaller QDs, bigger QDs & smaller sheets and bigger sheets, respectively.

**Introduction**

- Transition metal dichalcogenides (TMDs) have been investigated with great attention because of their promising optical, electrical and mechanical properties.
- Among TMDs, MoS\(_2\) shows photoluminescence (PL) in quantum dots (QDs) or a few layered nanosheets.
- In the present study, highly photoluminescent MoS\(_2\) QDs dispersed on MoS\(_2\) nanosheets (MoS\(_2\) QDNS) were synthesized using hydrothermal treatment, which shows excitation dependent emission, that cover a major portion of visible spectra.

**Characterization**

TEM images and corresponding SAED pattern of MoS\(_2\) QDNS.

**Results and Discussions**

**Synthesis**

\[ \text{aq. NaOH} \]  
Hydrothermal conditions  
220 °C for 8 h  
Bulk MoS\(_2\) bilayered MoS\(_2\) QDNS

**Photophysical Studies**

**Photographs of MoS\(_2\) QDNS**

**Visible light**

UV light

**Excitation Spectra at different collection wavelength**

Visible light absorption spectra of MoS\(_2\) QDNS.

**Time Resolved Fluorescence Spectral Studies**

Excitation Wavelength: 229 nm  
\( \lambda_{em} \)  
- 350 nm

Excitation Wavelength: 344 nm  
\( \lambda_{em} \)  
- 450 nm

Excitation Wavelength: 453 nm  
\( \lambda_{em} \)  
- 600 nm

Excitation Wavelength: 611 nm  
\( \lambda_{em} \)  
- 600 nm

**Conclusions**

- Uniform and monodisperse QDs of size 2-4 nm over mono or bilayer of MoS\(_2\) sheets are synthesized from commercially available MoS\(_2\) powder via hydrothermal reaction route.
- The MoS\(_2\) QDNS shows high fluorescent emission from blue to near red region.
- Thorough photophysical characterization including lifetime studies demonstrated that higher energy emission corresponds to smaller QDs, medium energy emissions stem from bigger dots as well as smaller sheets and lower energy emission originated from bigger sheets present in the system.

**Reference**

1. Neema Pallikkarthodi Mani, Manjunatha Ganiga, Jobin Cyriac;  
   *Chemistry Select, 2017*, (Accepted)

**Acknowledgements**

Authors acknowledge Indian Institute of Space Science & Technology (IIST) for funding and Amrita Institute of Medical Sciences (AIMS) Cochin, Cochin University of Science & Technology (CUSAT) Cochin, IISER Thiruvananthapuram for characterization.