

PREFACE

The present thesis entitled “**Tunable Luminescence of Graphene Based Nanomaterials: Role of Surfactants and Macromolecules**” addresses the synthesis of graphene based nano materials like graphene oxide (GO), graphene oxide polyaniline (GO-PANI) nanocomposite with tunable photoluminescence nature (PL). The role of surfactants like sodium dodecyl sulphate (SDS), cetyl trimethyl ammonium bromide (CTAB) has been also described to modulate the PL of GO. The entire work is carried out at the Department of Chemistry, Presidency University, Kolkata 700073 India, under the supervision of Dr. Arnab Halder.

This thesis comprises of eight chapters. *Chapter 1* deals with the general introduction and brief description of the summary of the research work. The motivation, objectives and plan of the present investigation are also stated in this chapter. *Chapter 2* deals with the properties and structure of graphene, the different method of synthesis of graphene existing in literature and the literature review on the photoluminescence properties of GO and GO based nanomaterials till 2020. *Chapter 3* describes the method of synthesis with the characterization of GO and GO-PANI nano-composite. *Chapter 4* discusses the effect of pH on the PL properties of GO-PANI nano-composite. The interactions between polyaniline and GO changes with the change in pH, which strongly affects the PL properties of the GO-PANI nanocomposite. *Chapter 5* includes the study of PL of GO in the aqueous medium in the presence of different concentration of surfactants (SDS and CTAB). The mode interaction between GO and surfactant strongly depends on the pH of the medium which modulates the band gap of GO are described in this chapter. *Chapter 6* includes the study of PL of GO-PANI in the aqueous medium in the presence of an anionic surfactant (SDS) at both acidic and alkaline medium. The interaction between GO-PANI and SDS is different in different pH, which modulates the PL of the GO-PANI nano-composite material. The modulation of luminescence property of GO by changing concentration has been described in *Chapter 7*. The conclusion of the research work along with the future prospects obtained from this thesis is presented in *Chapter 8*.

List of published research papers

1. **“pH dependent tunable photoluminescence of Polyaniline grafted Graphene Oxide (GO-PANI) nanocomposite”** P. Saha, D. K. Pyne, M. Pal, S. Datta, P. K. Das, P. Dutta, A. Halder, Journal of Luminescence, 181(2017) 138-146.
2. **“Effect of an anionic surfactant (SDS) on the photoluminescence of graphene oxide (GO) in acidic and alkaline medium”** P. Saha, D. K. Pyne, S. Ghosh, S. Banerjee, S. Das, S. Ghosh, P. Dutta, A. Halder, RSC Advances 8 (2018) 584-595.
3. **“Tunable Luminescence of Graphene Oxide-Polyaniline nano-composite: Effect of an anionic surfactant”** P. Saha, D. K. Pyne, P. Dutta, A. Halder, Journal of Luminescence, 206 (2019) 218-226.
4. **“Photoluminescence of Graphene Oxide: Effect of pH, Surfactant and Polymer”** D. K. Pyne, P. Saha, A. Halder, EPA Newsletter, 94, (2018), 11-21.
5. **“Photoluminescence amplification of cerium incorporated graphene oxide nano particles by photoinduced reduction: A mechanistic study highlighting structural orderness”** D. K. Pyne, S. Chatterjee, T. Biswas, P. Saha, P. Dutta, A. Halder, Journal of Luminescence, 235, (2021), 118019.

Papers presented in International/National Conferences

1. **“UV fluorescence of Graphene Oxide-Polyaniline (GO-PANI) nanocomposite comparison with Graphene Oxide”** Poster presentation in State Conference at 23rd West Bengal State Science and Technology Congress, January 28-29, 2016 at Presidency University, Kolkata.
2. **“pH dependent tunable photoluminescence of Polyaniline grafted Graphene Oxide (GO-PANI) nanocomposite”** Poster presentation in National Conference on Recent Developments in Chemistry, October 4-6, 2016 at National Institute of Technology, Durgapur.

3. **“pH dependent tunable Fluorescence of Graphene Oxide (GO) by the interaction with a surfactant (SDS)” Poster** presentation in National Conference on Recent Trends in Chemistry Research, March 25-26, 2017 at Visva Bharati, Department of Chemistry, Santiniketan, West Bengal.
4. **“Fluorescence Modulation of Graphene Oxide (GO) by the surfactant and Polymer” Poster** presentation in International Conference on Chemistry for Human Development (ICCHD-2018), January 8-10, 2018, at Heritage Institute of Technology, Kolkata
5. **“Modulation of photoluminescence of Graphene Oxide (GO) by the interaction with an anionic surfactant” Oral** presentation in International Conference on Current Trends in Material Science and Engineering (CTMSE 2018), January 19-20, 2018, Organised by IEM, Kolkata and SN Bose National Centre for Basic Sciences, Kolkata.

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List of Abbreviation

CTAB	Cetyl Trimethyl Ammonium Bromide
CVD	Chemical Vapour Deposition
CNTs	Carbon Nanotubes
DOS	Density of State
ESPT	Excited State Proton Transfer
FLE	Fluorescence Excitation Spectra
FT-IR	Fourier transform infrared spectroscopy
GO	Graphene Oxide
GQD	Graphene Quantum Dot
GO-PANI	Graphene Oxide Polyaniline (PANI) nanocomposites
NIR	Near Infrared
PANI	Polyaniline
PL	Photoluminescence
RGO	Reduced Graphene Oxide
SDS	Sodium Dodecyl Sulphate
SEM	Scanning Electron Microscopy
TEM	Transmission electron microscopy
UV	Ultra Violet
XPS	X-ray photoelectron spectroscopy
XRD	X-Ray Diffraction