Title : SYNTHESIS AND CHARACTERIZATION OF TITANIUM DIOXIDE-GRAPHENE QUANTUM DOTS NANOCOMPOSITES BY ELECTROCHEMICAL PROCESSES

Author(s) :
1. Thawatchai Khamaiam — **Student ID :** 650510362
2. — **Student ID :**
3. — **Student ID :**

Major : Physics

Advisor(s) :
1. Assistant Professor Dr. Sukrit Sucharitakul
2.
3.

Type of presentation* *(choose 1)* **:**

- ☐ **Oral Presentation** (เฉพาะ ตัวแทนนศ.ที่สาขาเลือกให้นำเสนอแบบบรรยาย)
- ☑ **Poster** (กรณี นำเสนอผลงานปัญหาพิเศษ/การค้นคว้าอิสระ)
- ☐ **Cooperative Education** (กรณี นำเสนอผลงานสหกิจศึกษา)

ABSTRACT

Titanium dioxide (TiO_2) is a highly stable semiconductor known for its exceptional optical and electrical properties. However, its efficiency is often limited by the high recombination rate of electron-hole pairs. To enhance its performance, TiO_2 can be hybridized with Graphene Quantum Dots (GQDs)—carbon-based nanomaterials renowned for their superior luminescence and chemical stability. This research aims to investigate the physical and optical properties of TiO_2QDs/GQDs nanocomposites and analyze the effects of synthesis voltage on these properties. The composites were synthesized via an electrochemical process using an electrolyte solution of 0.3 M potassium chloride and 0.1 M citric acid. The applied voltage was set at 10V for pure TiO_2, while varying voltages of 2V, 4V, and 6V were used for the TiO_2QDs/GQDs mixtures. The results indicated that the pH of the resulting solutions remained within the range of 2–3. Optical absorption analysis using the Tauc plot method revealed an energy band gap ranging from 3.57 to 3.65 eV. Photoluminescence (PL) analysis clearly demonstrated the enhanced luminescent behavior of the nanocomposites. Furthermore, Dynamic Light Scattering (DLS) analysis showed that the TiO_2/GQDs synthesized at 6V exhibited an average hydrodynamic size of 111.00 nm, which is significantly smaller than

**Type of presentation must be matched with an option you choosing on student upload system.*

***The abstract can be more than one page and must be approved by project advisor before upload.*

that of pure TiO_2 135.09 nm. These findings suggest that the applied voltage plays a critical role in controlling particle size and material properties, allowing for the fine-tuning of the synthesis process based on specific applications.

Keywords: Titanium Dioxide, Graphene Quantum Dots (GQDs), Titanium Dioxide Quantum Dots (TiO_2QDs), Electrochemical Process, Band Gap, Hydrodynamic Size, Nanocomposites.

**Type of presentation must be matched with an option you choosing on student upload system.*

***The abstract can be more than one page and must be approved by project advisor before upload.*

Title name guide.

ADVISOR title name / แปลไทย	
Professor Dr.	ศาสตราจารย์ ดร.
Professor	ศาสตราจารย์
Associate Professor Dr.	รองศาสตราจารย์ ดร.
Associate Professor	รองศาสตราจารย์
Assistant Professor Dr.	ผู้ช่วยศาสตราจารย์ ดร.
Assistant Professor	ผู้ช่วยศาสตราจารย์
Dr.	ดร.
Lecturer	อาจารย์
Mrs.	นาง
Ms.	นางสาว
Mr.	นาย

Major name guide.

SCIENCE MAJOR name / แปล	
Biology	ชีววิทยา
Microbiology	จุลชีววิทยา
Zoology	สัตววิทยา
Biochemistry and Biochemical Technology *or* Biochemistry and Biochemical Innovation	ชีวเคมีและชีวเคมีเทคโนโลยี *หรือ* ชีวเคมีและชีวเคมีนวัตกรรม
Chemistry	เคมี
Industrial Chemistry	เคมีอุตสาหกรรม
Materials Science	วัสดุศาสตร์
Physics	ฟิสิกส์
Computer Science	วิทยาการคอมพิวเตอร์
Data Science	วิทยาการข้อมูล
Mathematics	คณิตศาสตร์
Statistics	สถิติ

**Type of presentation must be matched with an option you choosing on student upload system.*

***The abstract can be more than one page and must be approved by project advisor before upload.*

Gemology	อัญมณีวิทยา
Geology	ธรณีวิทยา
Environmental Science	วิทยาศาสตร์สิ่งแวดล้อม

**Type of presentation must be matched with an option you choosing on student upload system.*

***The abstract can be more than one page and must be approved by project advisor before upload.*