Title : The development of sustainable TiO_2(B)/MOFs nanocomposites as an anode material in lithium-ion batteries

Author(s) : 1. Patrapee Sarapan **Student ID :** 640510150

Major : Industrial Chemistry

Advisor(s) : 1. Assistant Professor Dr. Yothin Chimupala

Type of presentation* *(choose 1)* :

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

ABSTRACT

This study investigates the development of TiO_2(B)/MOF composites as an anode material for lithium-ion batteries (LIBs). The novelty of this research lies in the synthesis of metal-organic frameworks (MOFs), specifically MIL-53(Al), derived from waste materials, and their deposition onto bronze-phase titanium dioxide (TiO_2(B)), which exhibits enhanced charge transfer properties and superior structural stability. The integration of these materials significantly improves the electrochemical performance of MOFs in battery applications. MIL-53(Al) was synthesized using polyethylene terephthalate (PET) from plastic bottles to produce terephthalic acid (TPA), which was subsequently reacted with aluminum (Al) extracted from aluminum cans to yield the final MOF product. TiO_2(B) was synthesized by a reaction between TiO_2 precursor and NaOH through hydrothermal and ion exchange processes, followed by calcination at 450°C for 5 hours. TiO_2(B)/MOF composites were synthesized using two distinct methods: physical and chemical, with weight ratios of MOF: TiO_2(B) of 25:75, 50:50, and 75:25. In the physical method, the components were mechanically mixed in a mortar for 30 minutes. In the chemical method, TiO_2 was combined with TPA during the reaction, followed by the addition of an aluminum solution. The morphology of the composite materials was characterized using scanning electron microscopy (SEM), which revealed that the MOF particles were large and angular in shape, with TiO_2(B) nanorods distributed across the surface of the MOFs. X-ray diffraction (XRD) analysis was employed to confirm the crystal structure, validating that the synthesized TiO_2 corresponded to the bronze phase. The composites synthesized via the physical method were subsequently incorporated into coin cell batteries to assess the influence of synthesis methods and

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

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

compositional ratios on battery performance. Electrochemical testing demonstrated that the composite with a MOF: TiO_2(B) ratio of 25:75 wt.% exhibited the highest cycling stability, attaining a specific capacity of 136.06 mAh/g at a current density of 100 mA/g after 50 cycles. This study suggests that an increased TiO_2(B) content enhances battery performance due to its stable framework and high porosity, making it a promising candidate for next-generation anode materials in lithium-ion batteries.

**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.*