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DEVELOPMENT OF EXTENDED BORON-DIPYRROMETHENE DERIVATIVES FOR
OPTOELECTRONIC APPLICATIONS

Miss Jittikarn Songkhao

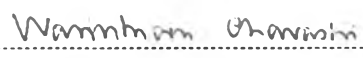
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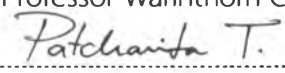
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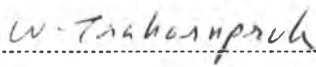

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งานวิจัยนี้อธิบายการสังเคราะห์สารประกอบเบนโซบอดีฟิที่มีการแทนที่ของหมู่ไทโอฟีนจำนวน 1 และ 2 วงบนตำแหน่งมีโซ และศึกษาสมบัติทางกายภาพเชิงแสงกับสารประกอบบอดีฟิอื่นที่มีการแทนที่ของเพนิลบนตำแหน่งมีโซ ไทโอฟีนจำนวน 1 และ 2 วงถูกเพิ่มเข้าไปในบอดีฟิที่มีการขยายระบบไพเพื่อขยายระบบคอนจูเกต ให้มีความสามารถในการละลายเพิ่มขึ้นและปรับปรุงสมบัติกายภาพเชิงแสงให้ดีขึ้น สารประกอบที่สังเคราะห์ได้ทั้งหมดสามารถยืนยันได้ด้วยเอ็นเอ็มอาร์สเปกโตรสโกปี แมสสเปกโตรเมทรี การดูดกลืนแสงและการคายแสง ข้อมูลทางสเปกโตรสโคปีแสดงให้เห็นค่าการดูดกลืนแสงและการคายแสงสูงสุดของบอดีฟิเป้าหมายเคลื่อนที่ไปทางช่วงแสงสีแดงอย่างมีนัยสำคัญ เมื่อเปรียบเทียบกับบอดีฟิมาตรฐานชนิดอื่นๆ เมื่อมีจำนวนวงไทโอฟีนและขยายระบบไพของบอดีฟิเพิ่มขึ้น ซึ่งจากผลการทดลองชี้ให้เห็นแนวทางการพัฒนาสารประกอบโมเลกุลขนาดเล็กเชิงแสงสำหรับอุปกรณ์อิเล็กทรอนิกส์เชิงไฟฟ้า

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JITTIKARN SONGKHAO: DEVELOPMENT OF EXTENDED BORON-DIPYRROMETHENE DERIVATIVES FOR OPTOELECTRONIC APPLICATIONS. ADVISOR: ASST. PROF. PATCHANITA THAMYONGKIT, Ph.D., CO-ADVISOR: ASST. PROF. ROJRIT ROJANATHANES, Ph.D., 110 pp.

This research describes the synthesis of benzo-BODIPYs compounds bearing mono- and bithienyl unit on their meso position and investigation of their photophysical properties in comparison with those of meso phenyl substituted ones. Mono- and bithienyl were introduced into pi-extended BODIPYs in order to extend the conjugated system, enhance the solubility and improve photophysical properties. All synthesized compounds were confirmed by NMR spectroscopy, mass spectrometry, and absorption and emission spectroscopy. The spectroscopic data revealed that the absorption and emission maxima of the target BODIPYs exhibited significant red shifts compared to those of the benchmark BODIPYs when the number of the thienyl rings and pi-extension of BODIPY unit were increased. This observation is a useful guideline for the development of other small-molecule photoactive compounds for optoelectronic applications.



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LIST OF ABBREVIATIONS

λ_{abs}	:	absorption wavelength
λ_{ex}	:	excitation wavelength
λ_{em}	:	emission wavelength
δ	:	chemical shift
J	:	coupling constant
$^{\circ}\text{C}$:	degree Celsius
ϵ	:	molar absorptivity
$\text{BF}_3 \cdot \text{Et}_2\text{O}$:	Boron trifluoride diethyletherate
calcd	:	calculated
cm^{-1}	:	unit of wavenumber (IR)
$^{13}\text{C-NMR}$:	carbon-13 nuclear magnetic resonance spectroscopy
d	:	doublet (NMR)
DBU	:	1,8-diazabicyclo (5,4,0) undec-7-ene
DDQ	:	2,3-dichloro-5,6-dicyano benzoquinone
g	:	gram (s)
h	:	hour (s)
$^1\text{H-NMR}$:	proton nuclear magnetic resonance spectroscopy
Hz	:	hertz (s)
m	:	multiplet (NMR)
MALDI-MS	:	matrix-assisted laser desorption ionization mass spectrometry
MgSO_4	:	Anhydrous magnesium sulfate
min	:	minute
mL	:	milliliter (s)
mmol	:	millimole (s)
MS	:	mass spectrometry

NaHCO ₃	:	Sodium bicarbonate
NEt ₃	:	Triethylamine
NIR	:	Near infrared spectroscopy
nm	:	nanometer
NMR	:	nuclear magnetic resonance spectroscopy
Na ₂ SO ₄	:	Anhydrous sodium sulfate
Obsd	:	observed
PCBM	:	Phenyl-C ₆₁ -butyric acid methyl ester
PEDOT:PSS	:	Polyethylenedioxythiophene:polystyrenesulfonate
P3HT	:	poly(3-hexyl thiophene)
ppm	:	parts per million
t	:	triplet (NMR)
TFA	:	Trifluoroacetic acid
UV-Vis	:	ultraviolet and visible spectroscopy

