

DOCTORAL THESIS

Synthesis and characterization of functional [pi]-conjugated oligomers for multi-photon absorption

Feng, Xinjiang

Date of Award:
2009

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**Synthesis and Characterization of
Functional π -Conjugated Oligomers for
Multi-Photon Absorption**

FENG Xinjiang

**A thesis submitted in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy**

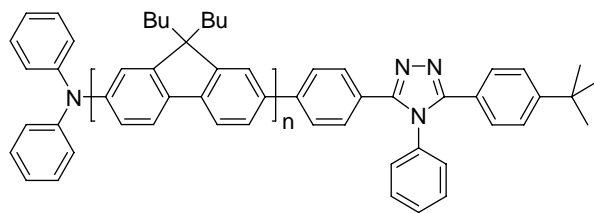
**Principal Supervisor: Prof. WONG Man Shing Ricky
Hong Kong Baptist University**

October 2009

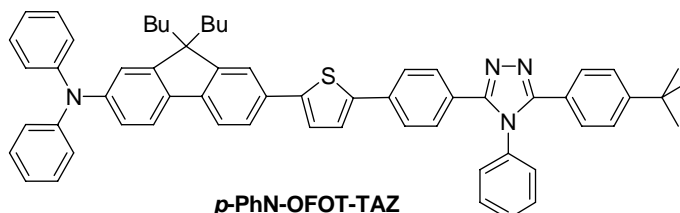
Abstract

Several novel series of monodisperse, well-defined π -conjugated oligomers, which included oligofluorenes and oligothiénylfluorenes asymmetrically end-capped with 1,2,4-triazole and diphenylamino groups ***p*-PhN-OF(*n*)OT(*m*)-TAZ**, $n = 2-6$, $m = 0-2$; Triazole containing oligofluorenes symmetrically end-capped with diphenylamino groups **PhN-OF(*n*)-TAZ-OF(*n*)-NPh**, $n = 1-4$; Bis-donor-acceptor chromophores based on carbazole, dibenzofuran and dibenzothiophene, **S2, V2, S3, V3, S2-S, V2-S, S3-S, V3-S, V-furan and V-sulfide**; as well as π -conjugated ladder-type phenylenes **(L)-Ph(3)** and **(L)-Ph(3)-NPh**, have been designed and synthesized in good to excellent yields on a few hundreds of micrograms to a few grams scale. All the newly synthesized π -conjugated oligomers were fully characterized with ^1H NMR, ^{13}C NMR, MS, and elemental analysis or high resolution mass spectrometry analysis (HRMS) and found to be in good agreement with the expected structures.

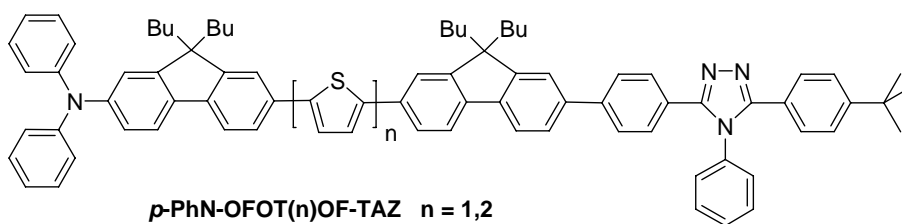
The functional properties, such as thermal, photophysical, and electrochemical properties of these newly synthesized molecular materials have been investigated by differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), UV-vis spectroscopy, fluorescence spectroscopy and cyclic voltammetric method, respectively. The multiphoton absorption properties such as up-converted fluorescence and lasing of these oligomers have been investigated and the structure-property relationships have been discussed. The performance of bis-donor-acceptor chromophores based on carbazole as two-photon fluorescence probe and biomarkers have also been investigated. The structures of these newly synthesized π -conjugated oligomers are shown below:



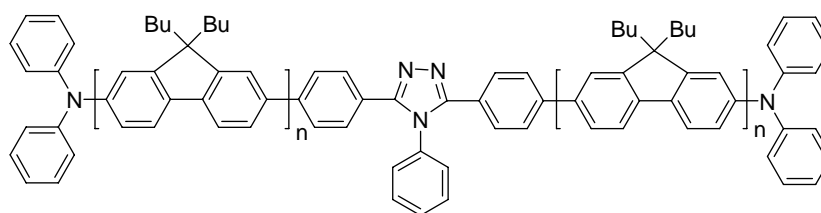
p-PhN-OF(n)-TAZ, n = 2-6



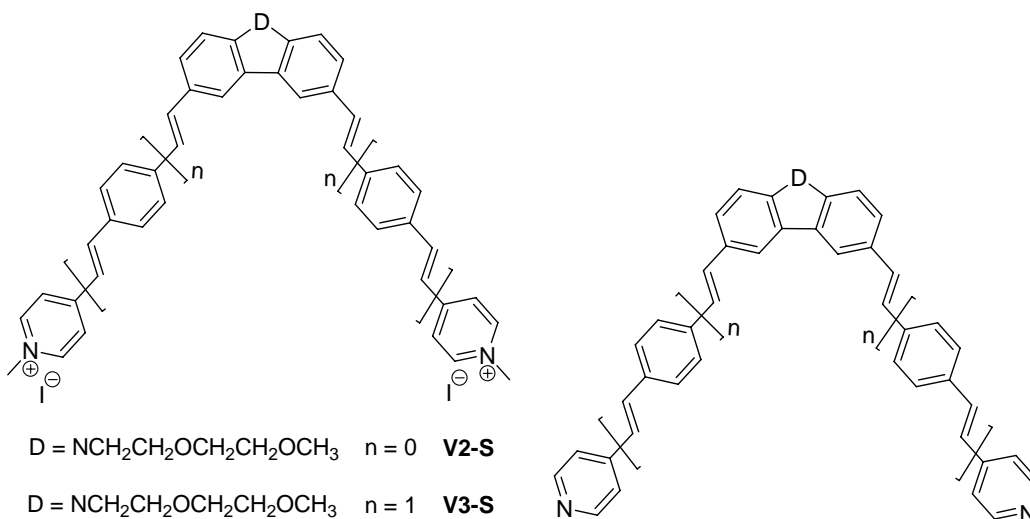
p-PhN-OFOT-TAZ



p-PhN-OFOT(n)OF-TAZ n = 1,2



PhN-OF(n)-TAZ-OF(n)-NPh n = 1-4



D = NCH₂CH₂OCH₂CH₂OCH₃ n = 0 **V2-S**

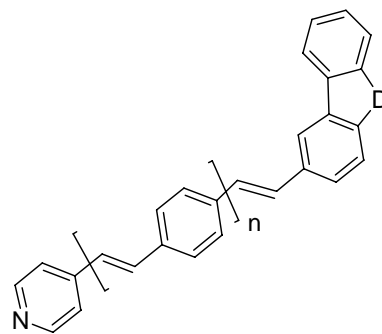
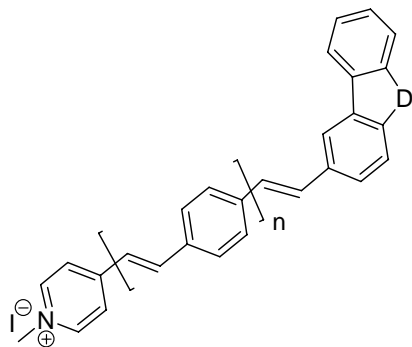
D = NCH₂CH₂OCH₂CH₂OCH₃ n = 1 **V3-S**

D = O n = 0 **V-furan**

D = S n = 0 **V-sulfide**

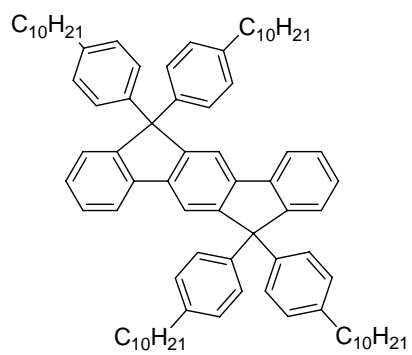
D = NCH₂CH₂OCH₂CH₂OCH₃ n = 0 **V2**

D = NCH₂CH₂OCH₂CH₂OCH₃ n = 1 **V3**

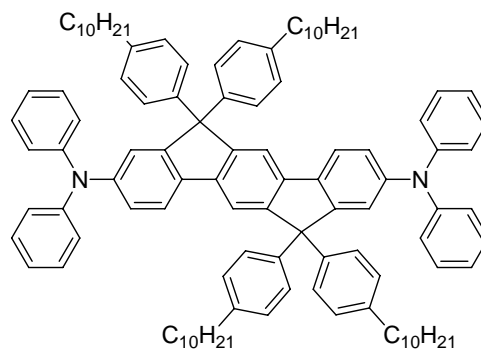


D = NCH₂CH₂OCH₂CH₂OCH₃ n = 0 **S2-S** D = NCH₂CH₂OCH₂CH₂OCH₃ n = 0 **S2**

D = NCH₂CH₂OCH₂CH₂OCH₃ n = 1 **S3-S** D = NCH₂CH₂OCH₂CH₂OCH₃ n = 1 **S3**



(L)-Ph(3)



(L)-Ph(3)-NPh

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