

DOCTORAL THESIS

Synthesis and investigation of novel [pi]-conjugated oligomers for electroluminescent and nonlinear optical applications

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**Synthesis and Investigation of Novel π -Conjugated Oligomers
for Electroluminescent and Nonlinear Optical Applications**

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

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Abstract

Several novel series of monodisperse, well-defined π -conjugated oligomers, which included symmetrical diphenylamino end-capped π -conjugated oligophenylenes **OPP(*n*)-NPh**, $n = 4-6$; asymmetrical diphenylamino and anthryl end-capped oligophenylenes **OPP(*n*)-NPhAn**, $n = 2-5$; X-branched π -conjugated oligophenylenes **X-OPP(5)-R** and **X-OPP(3)-R**; fluorine-containing X-branched π -conjugated oligophenylenes **X-OPP(5)-F_n**; diphenylamino end-capped oligo-9,9-dibutylfluorenes **OF(*n*)-NPh**, $n = 2-4$; bis-dipolar diphenylamino end-capped oligoaryl-9,9-dibutylfluorenes **OF(2)Ar-NPh** having electron-deficient aryl core; diphenylamino end-capped oligo-9,9-diphenylfluorenes **SOF(*n*)-NPh**, $n = 1-5$; as well as π -conjugated oligofluorene based dendrimers **SOF(*n*)-G₂**, $n = 1-3$, have been designed and successfully synthesized in good to excellent yields on a few of hundreds of micrograms scale using palladium-catalyzed Suzuki cross coupling as the key reaction. All the newly synthesized π -conjugated oligomers were fully characterized with ¹H NMR, ¹³C 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 electroluminescent performance of these π -conjugated oligomers as hole-transporting emitters or hole-blockers in OLED devices, as well as the nonlinear optical (two-photon absorption) properties of some molecular materials were investigated and structure-property relationships of these new compounds were also studied and

discussed. The structures of these newly synthesized π -conjugated oligomers were shown below:

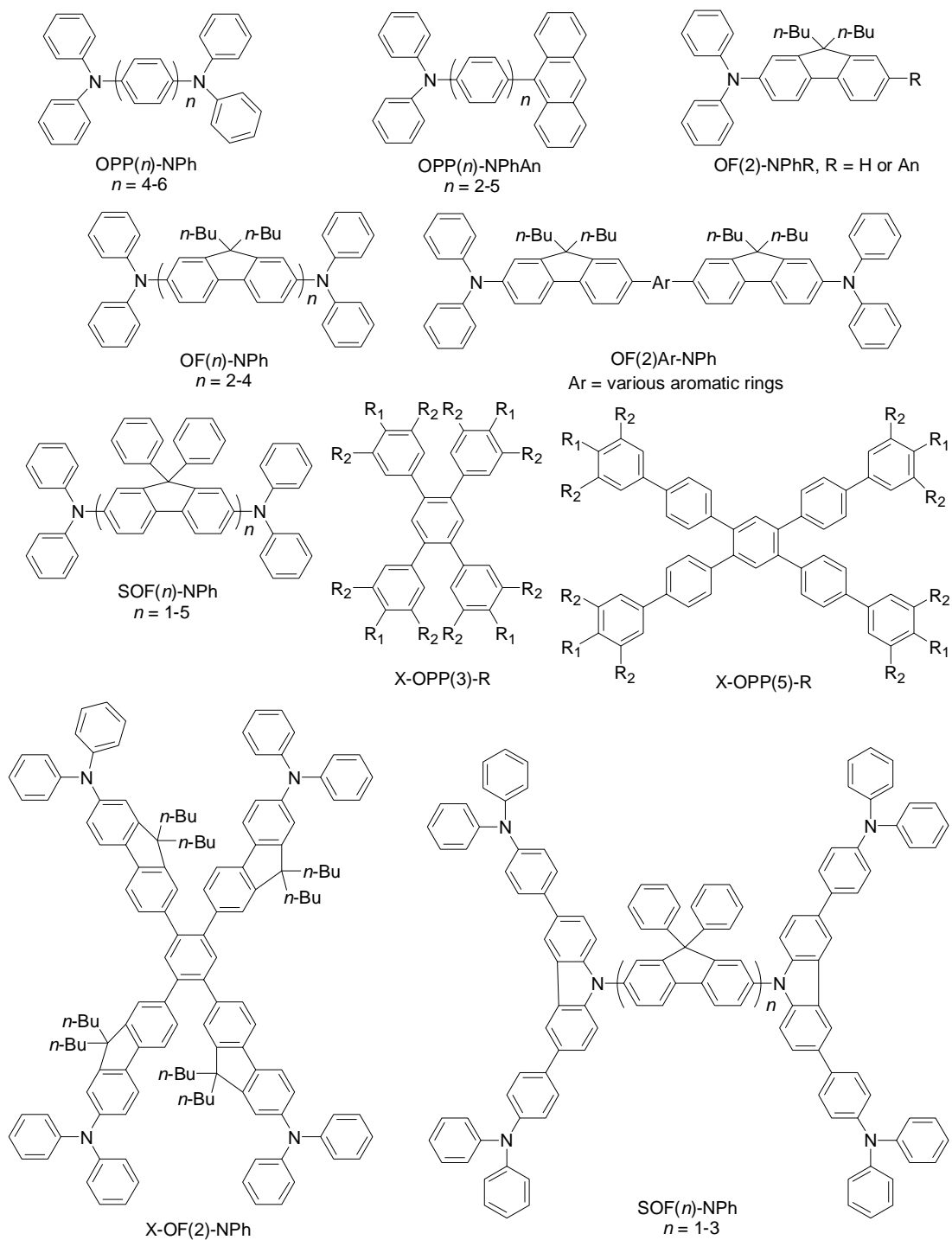


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