# Soutenance publique

au Département de chimie

de thèse de doctorat

# Madame Dandan Miao

## Bottom-Up Photochemical Synthesis of Structurally Defined Graphene Nanoribbons and Conjugated Polymers

**Résumé** : Graphene nanoribbons (GNRs), defined as nanometer-wide strips of graphene, have attracted increasing attention as promising candidates for next-generation semiconductors due to their high charge-carrier mobility, non-zero bandgap, as well as highly electronic conductivity. The band gap of GNRs can be precisely controlled by the width and edge configuration, providing GNRs with tunable optical and electronic properties.

The Lewis acid catalyzed cyclodehydrogenation reaction, known as the Scholl reaction, has been widely used to synthesize structurally well-defined GNRs with precise width and edge configurations on polyphenylene precursors. However, the Scholl reaction possesses some serious drawbacks that limit the scope and versatility of this reaction. Its poor regioselectivity results in structural defects which will affect the properties of GNRs. The undesired rearrangements and the use of a metal catalyst can lead to the formation of by-products. Moreover, the introduction of oxidant-sensitive functional groups and electron-rich heterocycles is difficult to achieve due to the harsh reaction conditions, which limits the diversity of structural and electronic properties of GNRs.

Recently, our group reported the synthesis of nanographenes and GNRs using the photochemical cyclodehydrochlorination (CDHC) reaction on polychlorinated polyphenylene precursors. The CDHC reaction possesses high regioselectivity and it proceeds without rearrangements or the formation of side-products. Furthermore, the CDHC reaction is conducted without metal catalyst and oxidant under very mild conditions, thus enabling the introduction of different functional groups and heterocycles onto the GNRS to modulate their optoelectronic properties.

This paper investigates in detail the usefulness of the CDHC reaction for the preparation of GNRs and conjugated ladder polymers (CLPs). The structural and optoelectronic properties of the polymers produced were carefully studied. The CLPs were successfully employed in the polymer solar cells and exhibited very promising performances. These results indicate the efficiency, versatility and practicality of the photochemical CDHC reaction.

***Tous sont invités à assister à cette soutenance***

Cette soutenance aura lieu le **mercredi 9 octobre 2019** à **13h30** au local **PLT-2505** du Pavillon Adrien-Pouliot

**Professeur Paul A. Johnson**
Département de chimie
Université Laval
Président et secrétaire du jury

**Professor Kenneth Maly**
Department of Chemistry and Biochemistry
Wilfrid Laurier University, Waterloo
Examinateur externe

**Professeure Josée Brisson**
Département de chimie
Université Laval

**Professeur Denis Giguère**
Département de chimie
Université Laval

**Professeur Jean-François Morin**
Département de chimie
Université Laval
Directeur de thèse

UNIVERSITÉ LAVAL

**Faculté des sciences et de génie**
Département de chimie