ParisTech

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RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM

Field: Chemistry, Physical Chemistry and Chemical Engineering
Subfield: Chemistry and Materials Science
Title: Synthesis of Biodegradable Polymers from Renewable Resources

ParisTech School: Chimie ParisTech | PSL

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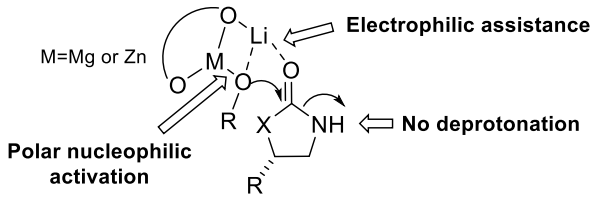
Research group/Lab: Organometallic Chemistry and Polymerization Catalysis
Lab location: 11 rue Pierre et Marie, 75005 Paris
(Lab/Advisor website): http://www.ircp.cnrs.fr/la-recherche/equipe-cocp/

Short description of possible research topics for a PhD:

The ring opening polymerization (ROP) of *N*-carboxyanhydrides (NCA) can yield homopolymers and block-copolymers with well-controlled structures where the repeat units are natural amino acids.[1] Similarly to proteins, these synthetic polypeptides possess well-defined secondary structures (α-helix and β-sheets), whereas synthetic polymers generally present a disordered coil structure. Therefore, these biomimetic polymers produce sophisticated superstructures with new material properties. Our aim will be to develop an efficient route from readily available reactants to synthesize new polypeptide analogues with a conserved ability to form well-defined secondary structures.



In this regard, there is growing evidence that magnesium or zinc derivatives can be effective catalysts for homogeneous polymerization. Their low toxicity, low cost, and accessibility make them attractive candidates for the development of affordable, sustainable and green catalysts. Bimetallic reagents are ideal candidates for this purpose since the polar organometallic moiety will act as a strong nucleophile with a concomitant electrophilic assistance created through the coordination of carbonyl oxygen of urea by the lithium cation. Therefore we want to use these bimetallic systems to synthesize aliphatic polyureas and polyurethanes via an auto-tandem catalytic transformation[2] where cyclic urethanes or ureas are synthesized from respectively epoxides or aziridines and subsequently polymerized by ROP.[3]

Required background of the student: Organic & Polymer Chemistry, Catalysis

A list of 5 (max.) representative publications of the group:

1. *Chem. Commun.*, **2014**, *50*, 13773.
2. *Nature Comm.*, **2011**, *2*, 586.
3. *Chem. Soc. Rev.*, **2013**, *42*, 9392.