Secteur des Sciences et Technologies

Invitation à la soutenance publique de thèse de

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Master degree in Science

Pour l'obtention du grade de Docteur en sciences

« Dynamic Polymer Hydrogels Based on the Orthogonal Combination of Reversible C=N bonds and Metal-Ligand Coordination Bonds »

qui se déroulera
le vendredi 20 août 2021 à 14h
Auditoire SUD 01
Place Croix du Sud
1348 Louvain-la-Neuve

Jury members :

Prof. Charles-André Fustin (UCLouvain), supervisor
Prof. Evelyne van Ruymbeke (UCLouvain), supervisor
Prof. Yann Garcia (UCLouvain), chairperson
Prof. Michael Singleton (UCLouvain), secretary
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Polymer hydrogels crosslinked by dynamic bonds are of increasing interest in fundamental and applied soft material studies. Unlike conventional static covalent gels, such hydrogels, thanks to the dynamic nature of the bonds, typically have controlled lifetimes, enhanced toughness, self-healing or stimuli responsive properties. However, most dynamic polymer hydrogels are constructed using a single type of dynamic bonds, either supramolecular interactions (e.g., hydrogen bonds, metal-ligand coordination bonds, host-guest interactions) or dynamic covalent bonds (e.g., C=N bonds, disulfide bonds, boronic ester bonds). The objective of this thesis is to construct dynamic hydrogels by orthogonal combination of supramolecular interactions and dynamic covalent bonds, and to investigate the effects of these combinations and of different network topologies on the hydrogel properties. Combinations of metal-terpyridine coordination bonds (zinc(II)-terpyridine and iron(II)-terpyridine bis-complexes) and reversible C=N bonds (acylhydrazone and oxime) were selected as crosslinks for interpenetrating polymer networks (IPN), dual-crosslinked networks (DCN) and double networks (DN). We have first systematically investigated the effect of four crosslink combinations on the dynamic oscillatory mechanical properties and pH responsiveness of IPN hydrogels. Then, the rheological behaviors of IPN, DCN and DN hydrogels based on the same combination of hydrolytically stable oxime bonds and labile zinc(II)-terpyridine bis-complexes as crosslinks were compared. Finally, we compared the rheological properties of two DN hydrogels made from either a combination of labile zinc(II)-terpyridine bis-complexes and stable oxime bonds, or a combination of labile acylhydrazone bonds and stable iron(II)-terpyridine bis-complexes.