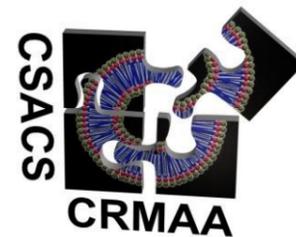


McGill Chemical Society Seminar Series



Tuesday, Feb. 7th, 2017, 1:00 PM
Otto Maass Chemistry Building, OM10



Prof. Benoît Lessard

University of Ottawa

Performance Improvement of organic electronic devices through Interface



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Engineering: from surface initiated polymerization off the electrodes to crosslinking silicon phthalocyanine additives.

Abstract:

Solution processed organic electronic devices, such as light emitting diodes (OLEDs) and organic photovoltaics (OPVs) have attracted a great deal of attention over the past decade and while great advances have been reported there are still some challenges that need to be overcome. For example, when fabricating more complex organic electronic devices with multiple thin layers, a great deal of care is required not to wash away the first layer with the addition of a second. We explored the use of nitroxide mediated polymerization (NMP) to facilitate 1) cross linking, 2) grafting-to and 3) grafting-from as possible techniques for the formation of robust interfacial hole transport layers between the electrode and the subsequent solution processed layer.¹ In all three cases these films proved to be robust and resistant to solvent washes while in comparison simple spin-coated films easily dissolved and wash away. These more robust films were also found to be electrochemically stable even after several washes, further justifying their use in the development of multi-layer organic electronic devices. These studies illustrate three robust routes for the fabrication of multilayered solution processed organic electronic devices.

Silicon phthalocyanine (SiPc) have two axial bonds originating from the Si atom which can serve as functionalization sites without affecting the inherent optoelectronic properties of the SiPc macrocycle itself. We have used these handles to engineer an enhanced solid state arrangement of the resulting SiPcs and incorporate them into planar heterojunction OPVs as either the donor or the acceptor molecules. The devices experienced as much as a 400% increase in efficiency when using these engineered SiPcs compared to the initial dichloro-SiPc.^{2,3} Additionally, these handles have also been used to synthesize solution processable ternary additives for P3HT:PC61BM bulk heterojunction OPVs with increased photo generation at the interface which translates to a 20% increase in overall efficiency.⁴ Recently we have reported the use of a multifunctional SiPc ternary additive that not only increase the efficiency of the OPV but also increases the stability by migrating to the interface and crosslinking the P3HT and PC61BM domains.⁵ These studies are showing potential for SiPcs in OPVs and the axial functionalization to enhanced device performance.

- (1) Melville, O. A.; King, B.; Imperiale, C. J.; Lessard, B. H. *Langmuir* 2016, 32, 13640–13648.
- (2) Lessard, B. H.; Grant, T. M.; White, R.; Thibau, E.; Lu, Z.-H.; Bender, T. P. J. *Mater. Chem. A* 2015, 3, 24512–24524.
- (3) Lessard, B. H.; et al. *ACS Appl. Mater. Interfaces* 2015, 7 (9), 5076–5088.
- (4) Lessard, B. H.; et al. *ACS Appl. Mater. Interfaces* 2014, 6, 15040–15051.
- (5) Grant, T. M.; Gorisse, T.; Dautel, O. J.; Wantz, G.; Lessard, B. H. *J. Mater. Chem. A* 2017, ASAP.

EVERYONE IS WELCOME!