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Towards high performance solvent-free fluidic devices

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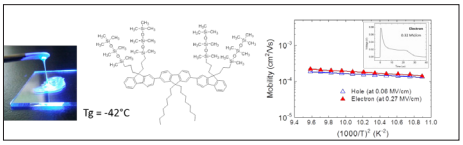

Solvent-free fluidic optoelectronics constitutes a milestone research area that aims at fabrication of ultimate stretchable and flexible devices. The advantages of such non-volatile liquid optoelectronic materials compared to conventional solid-state ones are many intrinsic resilience, excellent pore filling ability, solvent-free processing and possibility to compensate for the degradation (via microfluidic technology) by supplying the device with fresh liquid. In our lab, we had developed an efficient methodology to confer large aromatic species with a liquid state at room temperature via functionalization by siloxane chains. A series of emitters and semiconductors and their applications have been executed including their investigations in OLEDs and solar cells. Among the reported results, oligofluorenes led to solvent-free liquid compounds that exhibit both remarkable charge transport properties and strong fluorescence. The materials were found to exhibit ambipolar charge transport properties (hole and electron-transport) with mobilities of about 10-4 cm^2/Vs i.e. a value comparable to one of the best solid-state amorphous glasses used in various optoelectronic applications. These components allowed to realize the first distributed feedback (DFB) laser in a monolithic liquid semiconductor, given their high quantum yields (PLQY>80%) and extremely low threshold amplified stimulated emission (<2 μJ/cm^2). Overall, these results demonstrated that solvent-free liquid organic semiconductors functionalized by siloxane segments can compete in terms of photo physical and charge transport properties with organic glassy semiconductors, thus paving the way for the development of liquid optoelectronic devices. Further, the optimization of the metal-catalyzed methodologies and the design of the optimal siloxane chains (length, branching, etc.) to synthesize liquid hosts at room temperature are illustrated based on various families such as carbazolebiphenyl derivatives.

References

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Recent Publications

1. J Shaya, F Fontaine-Vive, B Y Michel, A Burger (2016) Rational design of push-pull fluorene dyes: synthesis and structure-photophysics relationship. Chemistry: *A European Journal;* 22: 10627-10637.
2. J Shaya, M A Deschamps, B Y Michel, A Burger (2016) Air-stable palladium catalytic systems for sequential one-pot synthesis of challenging unsymmetrical aminated products. *Journal of Organic Chemistry.* 81: 7566-7573.

Biography

Janah Shaya is a Postdoctoral Fellow and Instructor with the CNRS at the IPCMS of Strasbourg (Institut de Physique et Chimie des Matériaux de Strasbourg) in collaboration with Kyushu University, Japan. He had obtained his PhD degree with honor distinction and medal from University of Nice, Sophia Antipolis in France. His work was peer-reviewed and selected for filming for the ACS website at the American Chemical Society in Philadelphia. His principal axes of research are material sciences, biosensors, organic synthesis, photophysics electrochemistry and applications (energy storage systems and CO_2 valorization). He is currently the Co-Editor of two books on carbon dioxide and cross couplings with Interchopen publisher.

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