Patternable Polymers as Hole Transport Materials for Organic Light-Emitting Diodes

Benoit Domercq, Richard D. Hreha, Nathalie Larribeau, Joshua N. Haddock, Christopher Schultz, Yadong Zhang, Seth R. Marder, and Bernard Kippelen
Optical Sciences Center, The University of Arizona
Tucson, Arizona

Abstract

The preparation of multilayer structures by solution film-coating techniques is difficult because of the solubility of the bottom layer onto which the top layer will be cast. The utilization of precursor polymers and their thermal conversion into an insoluble film well established for instance for poly(p-phenylenevinylene) (PPV)[1] alleviates this problem.[2] A different approach is to convert soluble monomers[3] or pre-polymers[4-6] containing polymerizable moieties either as side groups or in the main chain into an insoluble material using photo-crosslinking reactions. However, such materials often require additional thermal treatment to obtain an insoluble layer, leading to a drop in performance. Here, we report the properties of a series of photo-crosslinkable acrylate hole transport polymers based upon copolymerization of substituted bis(diarylarmino)-biphenyl acrylate monomers and cinnamate acrylate monomers, and their use in OLEDs, using AlQ3 as emitting material. Only few seconds of UV exposure using a commercial mask aligner under ambient conditions are necessary to obtain an insoluble hole-transport layer with stable performance. Lifetimes under constant current operation of devices using these polymers have been measured and compared to their small molecules evaporated equivalents. Fully spin-coated EL devices have been fabricated using a blend of polystyrene and AlQ3.

References

1. J. H. Borroughes, D. D. C. Bradley, A. R. Brown, R. N. Marks, K. Mackay, R. H. Friend, P. L. Burns, and A. B. Holmes, *Nature*, 1990, 347, 539.
2. W. Li, Q. Wang, J. Cui, H. Chou, S. E. Shaheen, G. E. Jabbour, J. Anderson, P. Lee, B. Kippelen, N. Peyghambarian, N. R. Armstrong, and T. J. Marks, *Adv. Mater*, 1999, 11, 730.
3. (a) A. Bacher, C. H. Erdelen, W. Paulus, H. Ringsdorff, H.-W. Schmidt, and P. Schumacher, *Macromolecules*, 1999, 32, 4551; (b) M. S. Bayer, T. Braig, O. Nuyken, D. C. Müller, B. Groß, and K. Meerholz, *Macromol. Rapid Commun*., 1999, 20, 224.
4. X.-C. Li, T.-M. Yong, J. Grüner, A. Holmes, S. Moratti, F. Cacialli, and R. H. Friend, *Synth. Metals*, 1997, 84, 437.
5. E. Bellmann, S. E. Shaheen, S. Thayumanavan, S. Barlow, R. H. Grubs, S. R. Marder, B. Kippelen, and N. Peyghambarian, *Chem. Mater*., 1998, 10, 1668.
6. T. Braig, D. C. Müller, B. Groß, K. Meerholz, and O. Nuyken, *Macromol. Rapid Commun*., 2000, 21, 583.

Biography

Benoit Domercq is a graduate of the Ecole Normale Superieure (Lyon) and of the University of Nantes (France). He received his Ph.D. degree in 1999 under the supervision of M. Fourmigue. He was awarded a postodoctoral fellowship from the French department of defense for one year and joined Professor Bernard Kippelen's group at the Optical Sciences Center at the University of Arizona. In 2000, he was appointed in the position of Assistant Research Scientist at the Optical Sciences Center. His current research interests are in the study of organic materials for opto-electronics applications.