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Novel Photo- patterning of Organic Semiconductors SHIYI LIU, AKRAM AL-SHADEEDI, BJÖRN LÜSSEM, Kent State University, Department of Physics, BJÖRN TEAM — Charge carrier mobility in organic semiconductors (OSCs) has been increased significantly over the last decade. Recently, a carrier mobility up to $43 \text{ cm}^2/\text{Vs}$ was reported by Yongbo et al [Yuan, Yongbo, et al, *Nature communications* 5:3005 (2014)]. Despite this increase in charge carrier mobility, high- resolution patterning of organic semiconductors is still challenging. Here we report on a novel patterning method—Double Layer Lithography (DLL) based on optical lithography and dry chemical etching. Recently, a set of fluorinated photoresist system was developed, which is compatible with most organic materials [Zakhidov, AlA., et al. *Advanced Materials* 20 (2008), 3481], thus open the possibility to utilize optical lithography to achieve high- resolution patterning and high yield of devices. Introducing protection layers in the process, we are able to pattern the structures using dry chemical etching, which provides reliable and fast pattern transfer and allows for large- scale integrated circuits. To demonstrate the versatility of the DLL method, we will discuss OFETs based on pentacene and DNNT. Despite the dry etching step, high charge carrier mobility and low hysteresis of the transfer characteristic are obtained. Due to the high yield, we are able to extract the contact resistance of the DNNT based OFETs with high precision. The DLL structuring method developed by us is a key technology for the development of novel organic device concepts. In particular the high yield and reproducibility will allow for building more reliable and powerful organic transistors and to integrate them into larger circuits.

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