Fabrication of crystalline films of 5,5”-bis(4-biphenylyl)-2,2’:5’2”-terthiophene by vaporized film deposition

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Thiophene/phenylene co-oligomer, especially 5,5”-bis(4-biphenylyl)-2,2’:5’2”-terthiophene (BP3T) is one of the most interesting and well recognized light-emitting organic semiconductor and effective gain media for organic laser [1]. Recently, electrically pumped gain-narrowed emission has been reported under ambipolar operation of an organic light-emitting transistor (OLET) with single crystal BP3T [2]. However, it is not easy to handle the OLET fabrication procedure with the single-crystal material under controlled size and thickness. Here, we report an alternative OLET fabrication process by using the vaporized film deposition (VFD) [3], which enable us to construct polycrystalline OLET without breaking the vacuum.

[Experiment] In the VFD method, BP3T was first physically vapor-deposited onto a glass substrate kept at room temperature. Then, the BP3T/glass sample was placed on the heater, faced up against a SiO_2/Si surface, which is spin-coated with fluoropolymer (CYTOP) as a buffer layer, as illustrated in Fig 1(a). The BP3T/glass was heated at 300°C under a vacuum of ~10^{-6} mbar, then BP3T was transferred onto the SiO_2/Si surface.

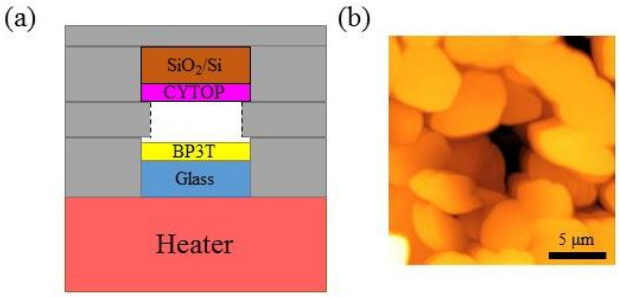

Fig 1 (a) VFD set-up, and (b) AFM image of polycrystalline BP3T film transferred onto SiO_2/Si surface

[Result & Discussion] An atomic force microscopy (AFM) image shown in Fig 1(b) indicates that the BP3T film transferred onto the SiO_2/Si surface and form a layer of the polycrystalline structure while the source film of BP3T on glass is composed of randomly pile granules. The size and thickness of the layered crystallite are averagely 5 μm and 150 nm, respectively. Their fluorescence microscopy suggests that the BP3T molecules orient standing in the layered crystallites which is a favorable configuration for carrier transportation in OLET and light-amplification in planar crystal cavity. OLET fabrication and measurement under all vacuum operation will be presented in the poster

References

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