Fabrication of nano metallic holes for color filter based on a controllable polystyrene spheres self-assemble

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Abstract Text:
Organic light emitting diode (OLED) has an enormous appliction potential in illumination and display, and color filter is a critical part for color OLED. Exciting the SPP， metallic nano-hole arrays can be used as a color filter with an enhancement transmission at special wavelength[1-3]. Comparing with band-pass filters, its efficiency and color quality is higher. In this paper, we reported an efficiency fabrication method to realize the large area metallic holes arrays in high efficiency and convenience. The schematic is shown in Fig. 1. The designed holes period is realized by selecting colloidal polystyrenes (PS) spheres with appropriate diameter, which are a closed-packed sigle-layer array on the glass substrate. Then, PS spheres can be controllably reduced in diameter and separated from each other by RIE-assisted etching technology. And then, a metal layer are deposited onto the samples. In order to obtain the desinged metallic holes arrays, the PS spheres are removed by a lift-off process. Based on the method, we have fabricated successfully metallic holes arrays with feature sizes of range from 50nm to 450nm and periods range from 300nm to 500nm. Partially exparimental results are offerred in Fig. 2. The transmittance spectra of the holes arrays are also measured using USB4000–UV-VIS spectrophotometer and realized the enhancement transmission at 605.6nm、682.41nm and 810.2nm respectively, as shown in Fig.3. The maximum transmission but normalized to the area occupied by the holes is 9.8, shown in Fig 4.

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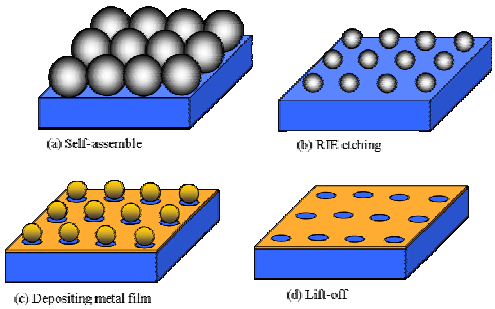
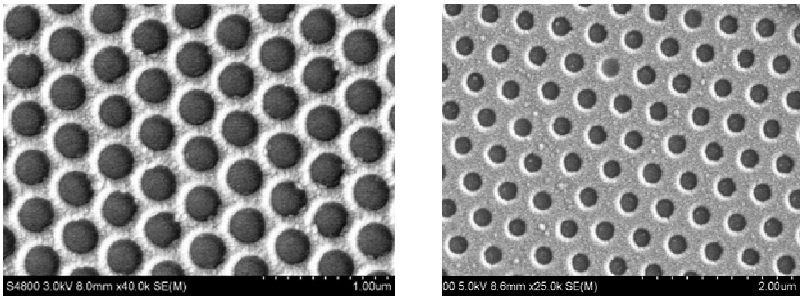


Figure 1. A schematic image describing the colloidal lithography process using RIE and ion-milling techniques.



(a) T=400nm (b) T=500nm

Figure 2. SEM image of holes with different period.

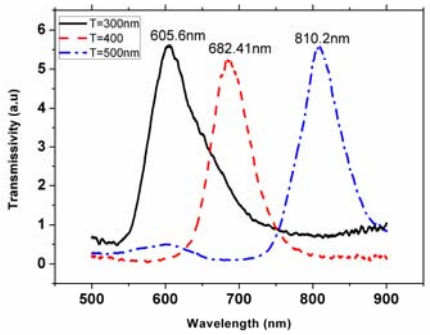


Figure 3. Transmittance spectra are enhanced at 605.6 nm, 682.41nm and 810.2 nm for holes periods of 300nm, 400nm, and 500nm respectively.

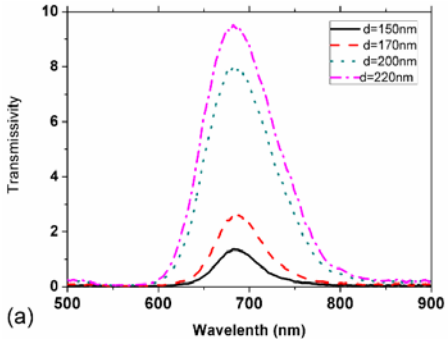


Figure 4. Transmittance spectra for 400 nm periods of the holes with different holes diameter.