Patterning And Passivation Of A Pentacene Thin Film

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Organic thin film transistors have been of great interest due to their low cost prcessibility and flexibility compared with other inorganic ones such as amorphous silicon, polysilicon thin film transistors. Among the candidates of many organic semiconductors, pentacene is the most promising one because of its relative high mobility, high on/off ratio, and stability. But, a pentacene thin film is so "weak" to usual solvents that it has not been able to carry out any other process on it, such as film-depositions, a lithography using photoresist, and so on. For the application of organic thin film transistors to various devices such as displays, smart cards, identification tags, etc., we have to develop the passivation and patterning processes of pentacene thin films.

In this study, we have developed the passvation layer for the pentacene thin films and was able to make a pattern of the films using a usual PR photolithography method. Poly(isobutylene) rubber (PIB) was used as the passivation layer and the PIB/pentacene films were etched by a plasma etch using CF_4/O_2 gases with a PR mask.

Figure 1 shows the electrical characteristics of the pentacene organic thin film transistor before and after the deposition of the rubber. Although the current after the deposition is decreased to a half of the value before the deposition, the transistor was stably operated.

Figure 2 shows the optical microsopic photographs of the patterned pentacene thin film using the above rubber layer. The photoresist using as a mask layer was able to be easily removed by PR stripper and during removing the PR layer, the PIB/pentacene layer was not affected. So, it is possible to carry out other deposition processes on the pentacene layer

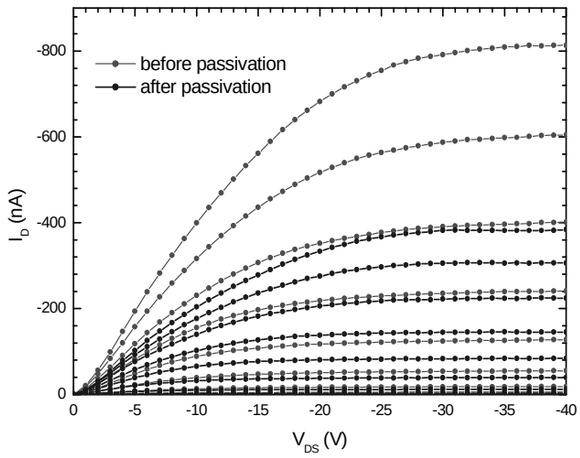
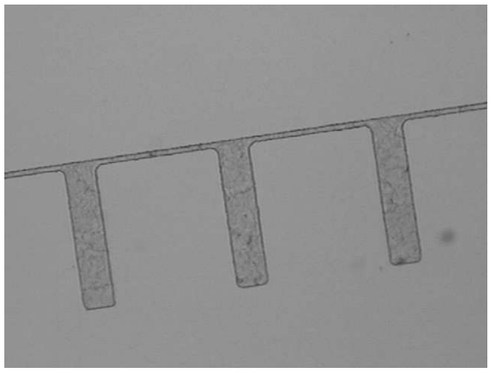
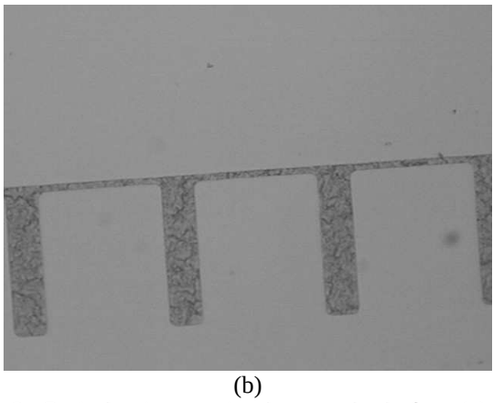


Fig. 1. Electrical characteristics of pentacene organic thin film transistor after and before the passivation using a rubber layer.



(a)



(b)

Fig. 2. Optical microscopic photographs before (a) and after (b) the etch of the PIB/pentacene layers.