

Large area batch ALD for flexible OLED display application

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In recent years, research areas and novel applications focusing on organic light emitting devices (OLEDs) have developed rapidly. Also flexible OLEDs are currently considered to be the most promising candidate for next-generation displays. However, there are still many problems that are inhibiting large scale industrialization of OLEDs. One of the major obstacles to realization of flexible OLEDs is reliable thin film encapsulation of OLEDs, because of the detrimental effect of moisture and oxygen on these devices. The water vapor transmission rate (WVTR) of the polymer substrate is substantially below the requirement for OLED applications (10^{-6} g/m²day). Inorganic single barriers, and inorganic nanolaminate barriers have shown potential to replace glass-lid encapsulation. During the development of encapsulation technology, since oxide films have to be of high quality to provide superior barrier performance, atomic layer deposition (ALD) is being pursued as an alternative to traditional chemical vapor deposition and physical vapor deposition methods. The inorganic/organic encapsulation method based on ALD has demonstrated better barrier performance and mechanical properties than single inorganic layers.

The other to realization of flexible OLEDs is the uniform electrical performance and stability of thin film transistor backplane in the large scale industries. An amorphous InGaZnO (IGZO) is one of the most attractive oxide semiconductors because of its advantages, such as a carrier high mobility, a superior uniformity, and a low-process temperature compatibility. So far, the IGZO thin film can be a very powerful solution, considering that the ALD provides us such benefits as a precise control of film thickness and composition, an excellent conformality, and a dense and homogeneous film structure. Furthermore these features can be uniformly obtained on a large-size substrate which is promising for large-area backplane applications.

In this work we will discuss about large area batch atomic layer deposition for flexible OLED display application such as thin film encapsulation, multi-buffer layer and IGZO oxide TFT backplane for mass production scale over 6 generation. Fig. 1 shows sixth generation batch atomic layer deposition system (Lucida™ GD-600).



Fig. 1. Sixth generation batch atomic layer deposition system (Lucida™ GD-600)