Chapter 1

Introduction

1.1 Introduction

Flat-panel displays (FPDs) are becoming increasingly commonplace in today's commercial electronic devices. FPDs are finding widespread use in many new products, such as cellular phones, personal digital assistants (PDAs), camcorders, and laptop personal computers (PCs). This generation of handheld electronics places stringent demands on their displays. FPDs in these devices are expected to be lightweight, portable, rugged, low-power and high-resolution. Displays having all these attributes will enable a wide variety of commercial applications in the future. The TFTs are the active elements, arranged in a matrix, on the display. The most advanced type of flat-panel displays, used in most portable computers, is active-matrix liquid-crystal displays. In this display, each of the million or so tiny screen pixels is controlled by thin-film transistors (TFTs) that act as tiny on/off electrical switches. By turning on and off dozens of times a second, the TFTs permit continuously changing images of words, pictures, and video.

The applications of thin film transistors (TFTs) in image sensors and displays are very widespread. Amorphous silicon (a-Si: H) TFT technology has shown to be a mature technology and thus TFTs are widely used for individually switched display elements (pixels) in flat panel displays (FPDs), primarily in portable laptop computers. The pixels comprise liquid crystals of which the transmissive or reflective optical properties can be altered by electrically charging or discharging them. These elements are arranged in large matrices along with their switching TFTs to form active matrix liquid crystal displays (AMLCDs). Although the mobility of a-Si:H TFTs is quite low, they are very suitable as the pixel switches in AMLCDs, since they can be fabricated over large areas (so that displays with >15 in. diameter are no longer an exception), with high yield and very uniform performance, while the low mobility is amply sufficient to charge the pixels within the row addressing time. A possible drawbackof a- Si: H TFTs is the threshold voltage shift after prolonged applied bias to the gate electrode. This effect has been proven to be an intrinsic property of a-Si: H rather than charge trapping in the gate dielectric. Nevertheless, the threshold voltage shift is not an issue in AMLCDs, since the total integrated duration of applied bias to each transistor ('ON time') over the life of a display is too short to produce any significant threshold voltage shift.

1.2 Motivation

Most commercially available AMLCDs use glass as the starting material in the display fabrication process. Glass has excellent optical clarity and is compatible with chemicals used in standard semiconductor processing. However, glass has the undesirable characteristic of being extremely fragile. As a result, displays must be handled carefully to avoid breakage. However, if plastic is employed as the starting material for display fabrication, we can achieve a display that is not only lightweight and rugged but also flexible. The realization of such a technology will have a significant impact on the display industry. It is, however, not a trivial task to fabricate displays on plastic.

Many significant challenges arise when plastic substrates are used in place of glass. Currently, TFTs for active-matrix displays are manufactured onto a rigid glass substrate in a process that involves baking glass sheets at temperatures of up to 600°C. This conventional process is far hotter than any plastic can withstand without deforming and melting.

Quite possibly, organic electronics could make ICs as hard to avoid as plastic, because the devices can be constructed on, and to some degree are made of, plastic. Slower than silicon, but more flexible and potentially much cheaper, organic electronics has already produced circuits with hundreds of transistors printed on plastic, experimental sensors and memories, and displays that bend like paper. Organic thin-film transistors OTFTs have received considerable attention recently because they can be fabricated at reduced temperature and potentially reduced cost compared to hydrogenated amorphous silicon thin-film transistors. Low fabrication temperature allows a wide range of substrate possibilities and makes OTFTs an attractive technology for many low-cost electronics applications, particularly those that require or may benefit from flexible polymeric substrates such as rf identification tags, smart cards, electronic paper, and flat panel displays. In the case of flat panel displays, the integration of OTFTs on polymeric substrates with liquid crystal materials or organic light emitters allows active matrix liquid crystal displays AMLCDs or active matrix organic light emitting diode displays that are flexible, lightweight, inexpensive, and rugged.

In this thesis, we separately try to study on the organic TFT and the a-Si:H TFT. They are all fabricated at an ultra low temperature. The inorganic thin film is deposited by the plasma enhanced chemical vapor deposition (PECVD) method at an ultra low temperature 100°C. The organic semiconductor P3HT film is deposited by spin coating and drop casting at room temperature.

1.3 Organization of This Thesis

The thesis is containing five chapters.

For the **chapter 1**, general introduction of this thesis will be described.

For the **chapter2**, the basic characteristics of the plastic substrate and the hard coating layers

For the **chapter3**, The Fabrication of amorphous silicon thin film transistor on the plastic substrate and the investigation of electrical of characteristics

For the **chapter4**, Study on the organic thin film transistor of the P3HT

Finally, conclusions and suggestions for the future research will be given in **chapter 5**.