S-11

Evaluation of elastic moduli of multi-layered thin films on polymer substrates using wrinkling analysis

한준현†, 문명운, 지광구, 한승희, Joost J. Vlassak*

한국과학기술연구원; *Harvard University
(jhhan@kist.re.kr†)

Multi-layered thin films on soft substrates are increasingly used in device applications such as flexible electronics. Since it is well known that the mechanical properties of thin films can be quite different from those of bulk materials, research engineers in the N/MEMS industry need to know the mechanical properties of thin films used in their devices for the purpose of reliability and performance estimation. The mechanical properties of a single-layer thin film on a substrate are readily measured using nanoindentation if film and substrate have similar properties. The technique has severe problems, however, when applied to stiff films on compliant substrates, a situation often encountered when dealing with flexible electronics. Moreover, the technique is not capable of measuring the mechanical response of the individual layers in a multi-layered thin-film system because the indentation response of a multi-layered system is not a simple sum of the responses of the individual layers. Clearly, there exists a need for a technique capable of measuring the mechanical properties of thin films on compliant substrates and of individual layers in multilayered systems.

One such technique relies on an analysis of the wrinkling patterns that develop in thin films on polymer substrates. When a stiff film on a compliant substrate is subjected to a compressive stress, thelarge elastic modulus difference between film and substrate allows the film to relieve the compressive stress by wrinkling. The period of the wrinkles is directly related to the stiffness mismatch between film and substrate.

Ti, Cu and Cu/Ti film stacks have been deposited polydimethylsiloxane (PDMS) substrates by means of DC magnetron sputtering. Wrinkle patterns developed as a result of the uni-axial compressive stress in the film stacks. The wrinkling pattern of the film stacks is analyzed and the elastic moduli of the individual films are extracted with knowledge of the wrinkling wavelengths and film thicknesses.

Keywords: elastic modulus, residual stress, wrinkling, Cu film, PDMS

S-12

잉크젯 프린팅을 이용한 유기 박막 트랜지스터의 전기적 특성

임종선†, 임현석, 김수지, 이학성, 이재민, 윤성철, 김동욱, 이창진

한국화학연구원
(jslim@krict.re.kr†)

최근 LCD, OLED 및 e-paper 등을 이용한 디스플레이가 상용화되면서 a-Si, poly-SiTFT를 대체할 수 있는 유기박막트랜지스터의 연구가 활발히 진행되고 있다. 이 유기박막트랜지스터는 낮은 공정 온도에서 저비용의 대면적 공정이 가능하고 잘 휘어지는 플라스틱 기판에 제작하여 가볍고 휘는 플렉서블 디스플레이를 구현할 수 있다는 장점을 가지고 있다. 그러나 아직까지 유기박막트랜지스터의 전하이동도가 낮고 적합한 공정기술 개발이 늦어지고 있어서 상용화가 되지 않고 있다. 본 연구에서는 유기박막트랜지스터 제작에 잉크젯 프린팅 기법을 이용하였고 유기반도체로 펜타센 유도체를 사용하였다. 이 펜타센유도체에 여러 가지 바인더 물질의 혼합에 따른 유기박막트랜지스터의 전기적 특성을 비교하였고 정공수송물질을 첨가하여 유기박막트랜지스터의 전기적 특성에 대하여 연구하였다.

Keywords: 잉크젯 프린팅, 유기박막트랜지스터