MICROSENSORS DEVELOPED ON FLEXIBLE SUBSTRATES FOR MEASUREMENTS ON SKIN

Auteurs : Garcia Castro Fatima, Le Bihan France, Coulon Nathalie, Simon Claude

IETR UMR CNRS 6164, Université de Rennes 1, Campus Beaulieu

Summary :

The subject of this work consists to developed microsensors on flexible substrate with inorganic materials, in particular microcrystalline silicon deposited at low temperature. The microcrystalline silicon technology has been used in the lab for flexible electronics, but also as an active element for mechanical sensors. This technology is based on very thin and flexible substrates to realize physiologic measurements (pulse, blood flow, measurement of muscle movements, skin conductivity…)

To do that, the devices was initially made on a 50 µm thick Kapton films. But the final objective is to transfer it on 25 µm thick Kapton substrates. However, one of the main problem of this thin substrate is the stress that it suffered. The stress creates cracks in each layers that made impossible the correct behavior of the resistances.(Figure 1.)

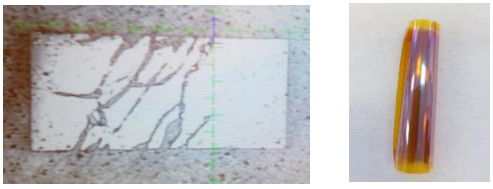

Figure 1 a) Cracks b) Roll on after µC-Si deposition

In order to avoid this phenomenon, various possibilities were studied, first using different structures with nitride silicon layers. A specific cleaning process was also defined and the design of a shadow mask that reduce the surface of the microcrystalline silicon deposition was proposed. The combination of the three methods made that our samples are flatten and the cracks disappear.

In addition, the resistivity was studied. Two types of processes have been carried out, observing that the value of the microcrystalline resistivity decreased by half (sample without glass compared to deposition on a glass substrate). Other two points that were also studied are the effect of the annealing on resistance values and the reliability of the devices with different deformation steps.

The results have now to be improved, especially by changing the design of the structure for easier measurements, without probes, adapted geometry of the active part of the device, but also compatible with deported contacts. For these goals, new masks were designed. (Figure 2).

Figure 2. Design of the new mask

They contain new resistances, with higher dimensions and therefore a better sensitivity. This new geometry is adapted to easy connections with instrumentation.

References :

[1]. Y. Kervran, O. De Sagazan, S. Crand, N. Coulon, T. Mohammed-Brahim, O Brel *Microcrystalline silicon: Strain gauge and sensor arrays on flexible substrate for the measurement of high deformations*. Sensors & Actuators: A. Physical 236 (2015) 273-280

[2]. S. Wagner, H. Gleskova, I-C Cheng J C. Sturm, Z. Suo. *Mechanics of TFT Technology on Flexible Substrates. Chapter 14. Book :*Flexible Flat Panel Substrate

[3]. D. K. Leung, M. Y. He A. G. Evans, *The cracking resistance of nanoscale layers and films.* Materials Department,College of Engineering, University of California, Santa Barbara