

Building flexible circuits

Jan Vanfleteren, University Gent/imec

A number of innovating technologies designed to tremendously increase user comfort in wearable and implantable electronics and sensor applications is on the horizon. Imec works on stretchable electronic circuits that can follow the random 3D shape of an object or body part, such as light sources for integration in textiles, and also develops an Ultra-Thin Chip Package (UTCP), which greatly reduces the thickness ($<100\ \mu$) and weight of packaged chips. The packaging allows use in systems that require extreme miniaturization, like hearing aids or smart lenses. Applications for flexible electronics can be found in smart textiles that require elastically deformable circuits, or circuits that need to be deformed only one-time, such as sensor layers that are embedded in composites to monitor structural health properties, or electronics embedded in randomly shaped plastics, such as lighting integrated in interior panels of cars.

The process of building these stretchable systems starts with commercially available silicon components. All electronic components are assembled on discrete flexible islands. These islands are then interconnected in-plane through meandering (horse shoe shaped) metal wires. The meandering shape of the wires gives them the property of 2D-springs, and allows the entire system to stretch elastically without changing the electric properties of the interconnections. For the islands, different materials can be used for the substrate, such as polyimide, PEN or PET. Finally, the whole system is embedded in a deformable polymer material with properties tuned to the final application. The polymer material can be elastically deformable, such as PDMS or polyurethane, or one-time deformable such as thermoplastic materials.

The ultra-thin chip package comes into play in order to keep the size of the flexible islands as small as possible. Standard silicon components are thinned down to less than $20\ \mu$ and are embedded in the polymer. The connection from the chip out of the substrate is made through Cu-plated micro-vias. The entire package is highly flexible, light weight, and less than $100\ \mu$ thick. These packages can be mounted on foil with other components, such as passives, mounted on top of it. These highly integrated and flexible component islands can be used independently wherever extreme system miniaturization is required.

Source URL (retrieved on 03/12/2014 - 9:46am):

<http://www.ecnmag.com/blogs/2013/07/building-flexible-circuits>