TECHNOLOGY OFFER

Multisensitive Smart Skin with high resolution

Graz University of Technology

This invention regards an electronic skin made of biocompatible materials, which -for the first time- can sense simultaneously temperature, humidity and force at sub-millimetric resolution. It can be applied on any substrate and integrated into robots or smart prostheses to allow them to be aware of their environment and identify (very small) surrounding objects.

BACKGROUND

The skin of humans and animals constitutes a specialized, complex system where body-external world interactions take place and interplay. Stimuli are captured by the skin and transformed into real world information content. Despite advances in our understanding of mechano- and thermosensation, replication of these unique sensory characteristics in artificial skins remains challenging. At the moment, different sensors have to be implemented in the electronic skin matrix for each stimulus. As a result, the existing technologies are complex, expensive, sometimes based on toxic materials or are not able to demonstrate multi-stimuli responsiveness and high resolution.

TECHNOLOGY

Smart Skin uniquely responds to three stimuli (force, humidity and temperature), as flexible skin-like sensor. The *design* of the Smart Skin device is *completely different* from the ones previously fabricated because in this case the sensitive element is not an extra-layer below the array of transistors but an array of sensitive vertical nanorods connected to the electrodes, leading to miniaturization and thus improving *the spatial resolution.* The to-date demonstrated spatial resolution of other electronic skin is 2 mm^2, the resolution of human skin is 1 mm^2 and the one demonstrated by Smart Skin is 0.25 mm^2 *(10 times the resolution of current electronic skins on the market) with low hysteresis*. The sensor response to finger touch and air blown from a human mouth demonstrates the sensor applicability as e-skin element in real-world environment.

ADVANTAGES

The high-gain aspects of Smart Skin's unique design are:

- **Vertical sensors** with a lateral dimension of only 500 nm embedded in 250 μm^2 pixels. This allows to achieve *unprecedently high resolution*.
- **3-in-1 sensitivity**: This *reduces the complexity* of the device, since one element is used to measure three stimuli, without the need for complex wiring of different sensors each for a single stimulus.
- **Scalability**: the sensing nanorods are produced with vapor-based fabrication methods, which are currently well established in production facilities of e.g., integrated circuits. The manufacture of our Smart Skin can therefore be easily scaled and implemented into existing production lines of other components of commercial robots, to make an example. This will be *beneficial* for the *cost/performance characteristics*.

Ref.no.: E_953

KEYWORDS:
Sensor for temperature
Sensor for humidity
Sensor for force
Flexible sensor
Electronic skin
High resolution

INVENTORS:
Anna Maria Coclite
Taher Abu Ali
Barbara Stadlober

COOPERATION OPTIONS:
R&D cooperation
Licence
Sales

DEVELOPMENT STATUS:
Prototype

STATUS OF PATENTS:
European Patent pending
PCT application filed

CONTACT:

Andreas Ruplitsch
Graz University of Technology
Research & Technology House
Mandellstraße 9/II
8010 Graz
T: +43 316 873 6928
andreas.ruplitsch@tugraz.at