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Abstract

A Multifunctional Electronic Skin Empowered with Damage Mapping and Autonomic Self-Healing

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Abstract:
Integrating self-healing capabilities into soft electronic devices and sensors is important for increasing their reliability, longevity and sustainability. Although some advances in self-healing soft electronics have been made, many challenges have been hindering their integration in digital electronics and their use in real-world conditions. We report on an electronic skin (e-skin) with high sensing performance toward temperature, pressure and pH levels - both at ambient and/or in underwater conditions. The e-skin is empowered with a novel self-repair capability that consists of an intrinsic mechanism for efficient self-healing of small-scale damages as well as an extrinsic mechanism for damage mapping and on-demand self-healing of big-scale damages in designated locations. The overall design is based on a multilayered structure that integrates a neuron-like nanostructured network for self-monitoring and damage detection and an array of electrical heaters for selective self-repair. This system has significantly enhanced self-healing capabilities; for example, it can decrease the healing time of micro-scratches from 24 hr to 30 sec. The developed electronic platform lays down the foundation for the development of a new sub-category of self-healing devices in which electronic circuit design is used for self-monitoring, healing and restoring proper device function.

Biography:

Hossam Haick is a professor at the Technion is an expert in the field of nanotechnology and smart sensors. He is the founder and leader of several European consortiums for the development of advanced generations of nanosensors for disease diagnosis. His research interests include nanomaterial-based chemical (flexible) sensors, electronic skin, nanoarray devices for screening, diagnosis, and monitoring of disease, breath analysis, volatile biomarkers, and molecular electronic devices.

Recent Publications:

1. Hossam Haick, et al; Strain Sensors: A Highly Aligned Nanowire-Based Strain Sensor for Ultrasensitive Monitoring of Subtle Human Motion (Small 24/2020), 2020.
2. Hossam Haick, et al; A Highly Aligned Nanowire-Based Strain Sensor for Ultrasensitive Monitoring of Subtle Human Motion, 2020.
3. Hossam Haick, et al; Exhaled breath diagnostics of lung and gastric cancers in China using nanosensors, 2020.
4. Hossam Haick, et al; Electronic Skin: A Multifunctional Electronic Skin Empowered with Damage Mapping and Autonomic Acceleration of Self-Healing in Designated Locations (Adv. Mater. 17/2020), 2020.
5. Hossam Haick, et al; A Multifunctional Electronic Skin Empowered with Damage Mapping and Autonomic Acceleration of Self-Healing in Designated Locations, 2020.

Webinar on Industrial Chemistry ; October 25, 2020; Paris, France.

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