**RFIDJOURNAL** VIRTUAL EVENTS

## New Wireless Sensors Apply Directly to Skin

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### SOFT APPROACH TO ELECTRONICS



The Persistence of Memory, Salvador Dalí, 1931



### **DEVICE-INTERCONNECT DESIGN**

#### Microscale stretchable battery :

• >300% biaxially, little loss over cycles





#### Mechanically robust construction for repeatable use:





Nat. Commun. 4, 1543 (2013) Adv. Mater. 25, 6839 (2013)

### **Bi-layer substrate**

- **Top:** soft -> stretchable
- Bottom: stiff -> high strength



### VARIOUS STRETCHABLE SENSORS

Stretchable LEDs



Nano Lett. 11, 3881 (2011)

Hydration and strain

Adv. Funct. Mater. 24, 3846 (2014)

#### **Temperature sensors**



#### Nat. Mater. 12, 938 (2013)

#### Fingertip electrode



#### Nanotechnology 23, 344004 (2012)

#### Near field communication



Small 11, 906 (2015)



### **CIRCUITS DIRECTLY SINTERED ON THE SKIN**







ACS Appl. Mater. Interfaces 12, 45504 (2020)

### **REDUCED ROUGHNESS**

#### Porous structure in paper and textile substrates





### **REDUCED SINTERING TEMPERATURE**



### **IMPROVED MECHANICAL PROPERTIES**





### PAPER/FABRIC-BASED FPCBS

6

4 OR/R

2

0

9

R/R0

3



3D origami paper structures





**Flexible printed** circuit board (FPCB)





### **STAMP TRANSFER PRINTING**

Polymer pattern on a wooden stamp



#### Stamping on the textured skin surface





### **ON-BODY SENSORS**



### **ENHANCED CONTACT QUALITY**



### **EASY REMOVAL OF SENSORS**



#### Removal of the device from the skin in warm water flow





### **FUTURE PERSPECTIVE**





ENGINEERING SCIENCE AND MECHANICS

### STRETCHABLE METAL ANTENNA



ENGINEERING SCIENCE AND MECHANICS

### **STRAIN-INSENSITIVE ANTENNAS**



### **AMBIENT RF ENERGY HARVESTING**



ENGINEERING SCIENCE AND MECHANICS

### **SELF-POWERED STRETCHABLE SYSTEMS**

#### Stretchable ZnP@LIG



Nano Energy 81, 105609 (2021)





### **BIOINSPIRED DUAL-MODE E-SKIN**





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**BIOINSPIRED DUAL-MODE E-SKIN** 



NG SCIENCE ANICS

# THANK YOU