

Liquid Metals for Stretchable and Soft Electronics

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This talk will discuss work in our group to use liquid metals as conductors for stretchable, soft, and reconfigurable electronics. We focus on alloys of gallium. These alloys are noted for their low viscosity, low toxicity, and negligible volatility. Despite the large surface tension of the metal, it can be molded into non-spherical 2D and 3D shapes due to the presence of an ultra-thin oxide skin that forms on its surface. The metal can be patterned by injection into microchannels or by direct-write techniques including 3D printing. Because it is a liquid, the metal is extremely soft and flows in response to stress to retain electrical continuity under extreme deformation. The ability of the oxide to reform instantaneously also allows the metal to self-heal in response to damage. In addition, the ability to remove the oxide electrochemically provides a new means to control the shape of the metal for reconfigurable electronics. Finally, we combine the metal with hydrogels to create electrodes, diodes, and memristor memory devices that are composed entirely out of soft, liquid-like materials. In addition to providing stretchable conductors with the best combination of elongation and conduction, these materials create comfortable interfaces with the skin for non-invasive sensing, self-healing circuits, and reconfigurable devices. The talk will also briefly mention recent work for sweat harvesting using these types of flexible and stretchable devices.