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Topic of the Speech:
Cr_2Te_3-Encapsulated Liquid Metal for Wearable Sensors

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Professor Xiuju Song is currently a Professor of School of Mechanical Engineering in Zhejiang University. She received her Doctor degree from Peking University on July, 2016. After that she has two years Postdoc experience in Prof. Manish Chhowalla's group from Rutgers University. Two year later she moved to University of Manchester as a Marie Curie Fellow and joined Prof. Cinzia Casiraghi's group. In May 2023, she joined in the Zhejiang University as a Professor.

Her research mainly focuses on synthesis of 2D materials for wearable sensors to detect various parameters, such as strain, humidity, strain, pH etc for wearable electronics. She has extensive experience on synthesis and characterization of 2D materials from her PhD in China. After joining the group of Prof. Casiraghi, she have decided to focus my research on printed sensors made of 2D material beyond graphene. While graphene has attracted strong attention because of its unique electronic properties, there are several challenges in the exploitation of this material in sensors, such as cross-sensitivity and hysteresis. She investigated the use of solution-processed 2D materials beyond graphene to fabricate stable and reliable sensors for wearable electronics. This material is characterized by excellent thermal and chemical stability and its surface properties can be easily tailored.

She has over 30 peer-reviewed publications on high impact journals including Nature, Nature Materials, Nature Communications, ACS Nano, etc. Her H index is 24 and her works have collected 4000 citations. She is the Youth editor of the international journal of The Innovation and the Frontiers of Nanotechnology. She is also co-inventor in one patent filed in China. She is a frequent referee for Nature Communications, ACS Nano, Applied Surface Science and Nanoscale Advances.

ABSTRACT SUBMISSION
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Cr_2Te_3-Encapsulated Liquid Metal for Wearable Sensors

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ABSTRACT (NO MORE THAN 500 WORDS:)

Gallium (Ga) based liquid metal (LMs) has been widely used in human-machine interface electronics due to its non-toxicity, high conductivity, deformability and unique surface chemistry. Because of these properties, LMs have been integrated as device components in electrical conductors for a variety of flexible and stretchable electronic devices, including soft robots, actuators, and sensors. Liquid metal-based electronic devices have been manufactured in various forms, including injection into microchannels, fiber or porous structures, mixing with other soft/elastic materials or dispersing in mechanically flexible composite electrodes, and application as functional droplets of a few millimeters. However, the exposed liquid metal tends to form an oxide layer, which causes the viscosity of the droplet surface and prevents it from deforming and moving precisely.

Here, we proposed a magnetic liquid metal droplet coated by two-dimensional transition-metal dichalcogenides (TMDs). Cr_2Te_3 nanoflake was chosen as a material for encapsulating liquid metals because of its intrinsic magnetic properties while having good mechanical frictional properties. Under a magnetic field, the droplet can be driven to produce accurate deformation due to the magnetic response of the surface Cr_2Te_3 layer. The droplet was tested to prove it has a mechanical strength and can maintain its structure and inherent properties under 5000 cycles of rolling. These characteristics enable the droplet to be used in deformable, mobile, high mechanical strength and magnetic field-driven floating electrode designs. Based on the above work, we designed a memory array that can be written by magnetic tracks. The array consisted of droplet-based memory elements, each of which can store a specified number of potentials and switch potentials by changing magnetic fields. The memory array made of liquid drops showed accurate magnetic track path recognition, so that the magnetic field information could be perceived, stored and learned. The stored electrical signal had a large signal-to-noise ratio, which ensures the accurate reading of the stored data. In addition, the upper limit of storage arrays increased exponentially with the number of components, which has a potential in the field of flexible storage devices. Besides, we designed a droplet-based vibration sensor, and its internal structure was specially designed for human gesture habits for recognizing four kinds of dynamic gesture. The successful sensing system will accelerate the development of motion pattern recognition, robot control and other fields.