THINKING SMALL TO MAKE BIG CHANGES

A research team from BEIHANG UNIVERSITY is committed to leading the country in micro-nano manufacturing and integration for precision instrument and intelligent systems.

Big dreams, such as making the world a smarter place, are usually achieved with small creative breakthroughs. Flexible, smart, wearable devices are such inventions that are likely to change our lives. Seeing flexible wearable technology as the future, a research team in Beihang University, a renowned top-tier comprehensive university in China, is dedicated to artificial intelligence technologies and the fabrication of flexible microwave and optoelectronic devices, exploiting advanced micro-nano manufacturing technology.

Flexible, smart and wearable devices often rely on biocompatible foldable substrates to be integrated into the human body. Great efforts have been made in this promising area in recent years, yet challenges remain. Conventional silicon-based micro-nanofabrication technique is not well matched with flexible substrates, causing difficulty in constructing flexible smart electronic devices with high-resolution and high-reliability. Also, as the organic semiconductor industry is still nascent, the lack of real soft flexible electronic components presents a long-term challenge for scientists to integrate smart systems.

The research team led by Shan Guangcun, a professor of the School of Instrumentation Science and Opto-electronic Engineering at Beihang University, is determined to address these challenges. It focuses on developing technology compatible with flexible substrates for high-resolution flexible devices and circuits following the concept of System-on-Chip (SoC), as well as progressive integration strategies for reliable smart systems. The team has been building flexible, ultrahigh frequency devices and/or high-precision radio frequency measurement technology, harnessing ultrahigh frequency electromagnetic waves to enable features such as high-precision measuring/sensing, long-distance wireless positioning, short-distance energy exchange and target identification in flexible electronics. Using two-dimensional nanomaterials, the research will lead to light, flexible and smart devices that have wide application in logistics tracking, public security, information services and medical diagnosis and treatment. The development of a high-precision microwave measurement and control system will enable accurate measurement of key parameters, say temperature, for such devices.

The team is also engaged in several key national projects, involving quantum sensing, marine nuclear safety, public safety, and flexible electronic devices for sensing. As part of China's ambition to boost its maritime nuclear capabilities, the marine security project seeks to design and fabricate large-capacity and high-selectivity absorbing systems for radionuclides. Based on functional nanomaterials, the team is turning the pioneering ideas of rapid radionuclides enrichment into reality.

Meanwhile, in another project supporting smart city construction, the team is exploring breakthrough artificial intelligence algorithms for flexible sensors to predict abnormal movement patterns for use in public security monitoring. Funding support from these projects have also led to some exciting research results, including deep learning methodology, flexible devices for radio-frequency measuring/sensing and high-resolution flexible circuits.

Mainly made up of young scientists with interdisciplinary education and research backgrounds covering electronic information, control and automation, materials science, chemistry and biomedicine, the team's young members draw inspiration from fruitful and frequent communication. With the establishment of world-class experimental and computation platforms, it is poised for original breakthrough results in developing the fabrication and integration of advanced flexible electronic devices, and new artificial intelligence algorithms. ■

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