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Flexible Electronic Devices

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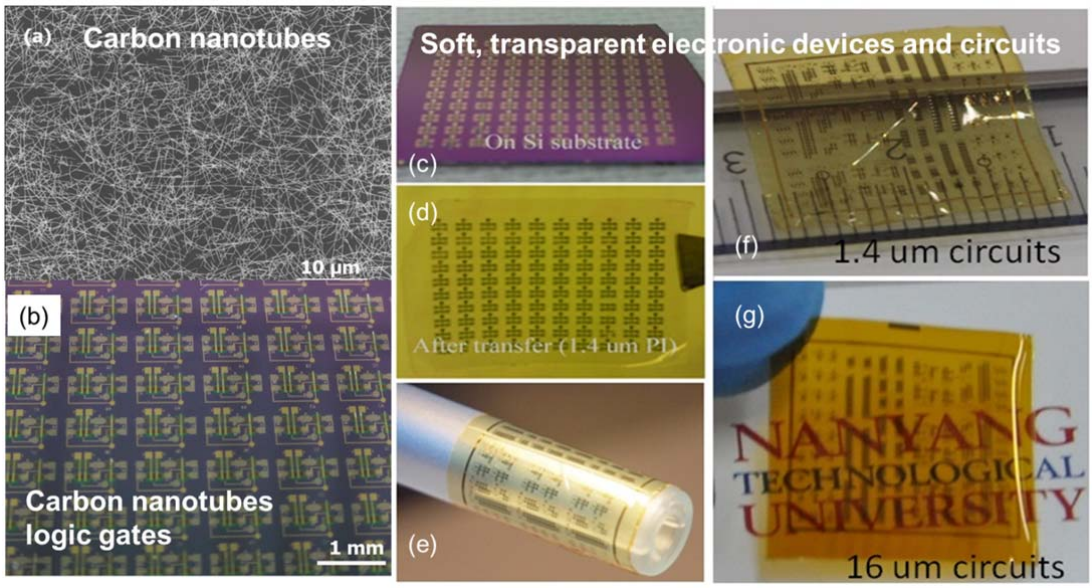
Till now, almost all electronic devices are made from semiconductors that are hard and brittle. However, many practical applications require electronic devices to be of flexibility so that the devices are suitable for flexible electronic applications, such as flexible displays, sensors, logic circuits, etc. The group led by Prof Zhang Qing has successfully developed a novel approach with which preformed carbon nanotube (CNT) based integrated circuits (ICs) on hard substrates can be encapsulated into polyimide (PI) and peeled off from the hard substrates to form flexible ICs. The flexible CNT-ICs show promising performance comparable to those circuits formed on hard substrates. [Pingqi Gao, Jianping Zou, Hong Li, Kang Zhang and Qing Zhang, "Complementary Logic Gate Arrays Based on Carbon Nanotube Network Transistors", SMALL, 9(2013)813; Pingqi Gao and Qing Zhang, "Encapsulate-and-Peel: Fabricating Carbon Nanotube CMOS Integrated Circuits in a Flexible Ultra-thin Plastic Film", NANOTECH, 25(2014)065301.] In addition, they have also presented novel light weight soft anodes for flexible and stretchable lithium ion batteries. A coaxial flexible Ni/PVDF nanofiber network is used as the freestanding current collector and active amorphous silicon is coated to form a core–shell structure of Si/Ni/PVDF nanofibers. The soft silicon anodes show high specific capacities and good cycling life. The soft battery is capable of powering a LED at different bending states. [Qizhen Xiao, Qing Zhang, Yu Fan, Xinghui Wang and Rahmat Agung Susantyoko, "Soft silicon anodes for lithium ion batteries", Energy Environ. Sci., 17(2014)2261].



Above: (a) The SEM image of CNT network on a silicon substrate; (b, c) CNT based logic gates on a silicon substrate; (d) Optical image of CNT based transistors, inverters, logic gates etc in a flexible PI sheet with a size of 2×1.8 cm^{-2} and a thickness of ~1.4 μm; (e) the PI sheet with the devices is attached on a pen with radius of 3.0 mm through electrostatic attraction; (f, g) the PI sheet with the devices are transparent.