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Stretchable graphene field effect transistor

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Future electronics will require stretchable and transparent devices, thereby enabling new applications that would be impossible to achieve by using the hard and rigid electronics of today. One of the difficulties in developing these stretchable devices is the development of a semiconducting channel material that has itself mechanical properties enough to operate stably under a high strain. However, the difficulty in developing semiconducting materials with high stretchability required for such applications has restricted the range of applications of stretchable electronics. To date, an amount of research has been mainly carried out conductive films such as conductive polymer composites, metal electrode-integrated rubber substrates and materials based on carbon nanotubes, and new structural configurations in brittle materials such as wavy pattern to expand the mechanical operation range.

In this work, we describe an all-graphene-based FET array on stretchable rubber substrates using a low-temperature printing process. The monolithic devices displayed excellent advantages, such as good mechanical stretchability and optical transmittance, as well as improved contact at the channel-to-S/D interface. Although several studies have reported flexible/stretchable graphene electrodes on plastic or rubber substrates, there are still significant challenges in fabricating stretchable graphene FETs on rubber substrate. This work suggests new approaches to solve these challenges.