Graphene based transparent, wearable soft-bioelectronics using thermally controlled transfer printing technique

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Graphene takes the spotlight as a platform material for use in electronics and optoelectronics. In spite of recent progresses to integrate individual graphene-based device components into all-graphene circuits/systems, challenges remain in relation to efficient fabrication processes. Such techniques must provide local resistance control, interfacial adhesion, high-quality contacts, and precise alignment of micrometer-scale patterns. Here, we report a thermally controlled transfer printing technique, which allows high-yield multiple patterned graphene transference at desired locations is presented. Using the thermal-expansion mismatch between the viscoelastic sacrificial layer and the elastic stamp, a "heating and cooling" process precisely positions patterned graphene layers on various substrates, such as graphene pre-patterns, hydrophilic surfaces, and superhydrophobic surfaces. The proposed transfer printing technique integrates graphene-based stretchable sensors and actuators, allowing an all-graphene, transparent, and wearable circuit/system to be developed.