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3D conformal graphene film for high-sensitivity pressure-sensitive sensors

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Graphene is a two-dimensional honeycomb lattice of carbon atoms, which possesses remarkable mechanical, electrical and optical properties and is considered as an ideal candidate of the next-generation transparent conductive films. For the practical applications, 3D superficial structures exist in a lot of functional devices, such as black silicon solar cells, cambered micro-optics and MEMS sensors etc. It is necessary that graphene film need to be conformally covered on the 3D structural surface. For traditional approach, graphene film was grown on Cu foil and then was transferred to the dielectric substrates by PMMA media. However, this traditional transfer method does not only bring the risk of damage and contamination, but was also difficult to conformally and tightly adhere 2D graphene onto the 3D-structural surface. The direct growth technique of graphene on dielectric substrates might provide one of the optional ways. Herein, we demonstrated that the direct CVD method is a simple and effective approach to produce conformal graphene films on 3D structural quartz substrate. This conformal graphene film possesses the relatively high conductive ability and transparency and can be directly used as an electrode in pressure-sensitive sensors. This device possesses the high-pressure sensitivity of -6.524 kPa^{-1} in a low-pressure range of 0-200 Pa. Meanwhile, this pressure-sensitive sensor exhibits super reliability (≥5000 cycles) and ultrafast response time (≤4 ms). Owing to these features, these pressure-sensitive sensors based on the 3D conformal graphene could be used to test wind pressure, expressing higher accuracy and lower background noise level than a market anemometer.

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