TF-001

Long-term Air Stability of Small Molecules passivated-Graphene Field Effect Transistors

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Electrical properties of graphene-based field effect transistors (G-FETs) can be degraded in ambient conditions owing to physisorbed oxygen or water molecules on the graphene surface. Passivation technique is one of a fascinating strategy for fabrication of G-FETs, which allows to sustain electrical properties of graphene in the long term without disrupting its inherent properties: transparency, flexibility and thinness. Ironically, despite its importance in producing high performance graphene devices, this method has been much less studied compared to patterning or device fabrication processes. Here we report a novel surface passivation method by using atomically thin self-assembled alkane layers such as C18- NH2, C18-Br and C36 to prevent unintentional doping effects that can suppress the degradation of electrical properties. In each passivated device, we observe a shift in charge neutral point to near zero gate voltage and it maintains the device performance for 1 year. In addition, the fabricated PG-FETs on a plastic substrate with ion-gel gate dielectrics exhibit not only mechanical flexibility but also long-term stability in ambient conditions. Therefore, we believe that these highly transparent and ultra-thin passivation layers can become a promising candidate in a wide range of graphene based electronic applications.

Keywords: graphene, FETs, passivation, Self-assembled alkanes

TF-002

Hafnium Carbide Protective Layer Coatings on Carbon/Carbon Composites Deposited with a Vacuum Plasma Spray Coating Method

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A pure hafnium-carbide (HfC) coating layer was deposited onto carbon/carbon (C.C) composites using a vacuum plasma spray system. By adopting a SiC buffer layer, we successfully integrated C.C composites with a 100-μm-thick protective coating layer of HfC. Compared to the conventional chemical vapor deposition process, the HfC coating process by VPS showed increased growth rate, thickness, and hardness. The growth behavior and morphology of HfC coatings were investigated by FE-SEM, EDX, and XRD. From these results, it was shown that the addition of a SiC intermediate layer provided optimal surface conditions during the VPS procedure to enhance adhesion between C.C and HfC (without delamination). The thermal ablation test results shows that the HfC coating layer perfectly protected inner C.C layer from thermal ablation and oxidation. Consequently, we expect that this ultra-high temperature ceramic coating method, and the subsequent microstructure that it creates, can be widely applied to improve the thermal shock and oxidation resistance of materials under ultra-high temperature environments.

Keywords: HfC, VPS, Hafnium carbide, carbon carbon composites