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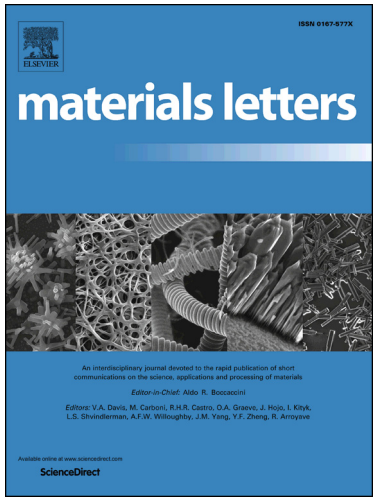

Thermal-assisted direct transfer of graphene onto flexible substrates

Zhiying Chen, Yanhui Zhang, Xiaoming Ge, Yanping Sui, Yijian Liang, Shike Hu, Jing Li, Guanghui Yu

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Thermal-assisted direct transfer of graphene onto flexible substrates

Zhiying Chen [a,b], Yanhui Zhang [a,b], Xiaoming Ge [a,b,c], Yanping Sui [a,b], Yijian Liang [a,b,c], Shike Hu [a,b,c], Jing Li [a,b,c], Guanghui Yu [a,b *]

[a] State Key Laboratory of Functional Materials for Informatics, Shanghai Institute of Microsystem and Information Technoloy (SIMIT), Chinese Academy of Sciences, 865 Changning Road, Shanghai 200050, China

[b] CAS Center for Excellence in Superconducting Electronics, 865 Changning Road, Shanghai 200050, China

[c] University of Chinese Academy of Sciences, No.19A Yuquan Road, Beijing 100049, China.

Abstract

We explored an easy technique to transfer directly large-area graphene grown by chemical vapor deposition (CVD) onto flexible substrates through substrate heating at appropriate temperatures. Polyethylene (PE) films were selected as the flexible substrate. The critical factor to ensure successful transfer was the good contact between the substrate and graphene. By heating the PE films merely approaching their glass-transition temperature, film morphology did not change. The stickiness of PE films further enabled the van der Waal forces to ensure close interaction between the viscoelastic substrate and graphene. This method did not require an intermediate transfer membrane such as polymethylmethacrylate (PMMA) that needs removal afterwards. Though this transfer method, monolayer and multilayer graphene films were transferred onto PE substrates with sheet resistance as low as 158 Ω/sq. All these results can be applied in existing and new graphene CVD applications on flexible substrates.

Keywords: graphene; flexible substrate; glass-transition temperature; PE; sheet resistance

Introduction

As of today, high-quality large-area monolayer graphene film has been synthesized successfully on a variety of metal substrates by CVD.1-4 Because of graphene's inherent flexibility, developing its applications on flexible substrates is advantageous. These applications include photonics, optoelectronics, and organic electronics, such as in solar cells and light-emitting diodes.5 To fabricate these devices, the transfer of graphene grown on metal to the target substrate is necessary.6 However, even the best-quality graphene can be

* Corresponding author. Tel.: +86-21-62511070-8965; E-mail: ghyu@mail.sim.ac.cn