83
标题: Switching terahertz waves with gate-controlled active graphene metamaterials
作者: Lee, SH (Lee, Seung Hoon); Choi, M (Choi, Muhan); Kim, TT (Kim, Teun-Teun); Lee, S (Lee, Seungwoo); Liu, M (Liu, Ming); Yin, X (Yin, Xiaobo); Choi, HK (Choi, Hong Kyw); Lee, SS (Lee, Seung S.); Choi, CG (Choi, Choon-Gi); Choi, SY (Choi, Sung-Yool); Zhang, X (Zhang, Xiang); Min, B (Min, Bumki)
来源出版物: NATURE MATERIALS 卷: 11 期: 11 页: 936-941 DOI: 10.1038/NMAT3433 出版年: NOV 2012
在 Web of Science 中的被引频次: 0
被引频次合计: 0
引用的参考文献数: 35
摘要: The extraordinary electronic properties of graphene provided the main thrusts for the rapid advance of graphene electronics(1). In photonics, the gate-controllable electronic properties of graphene provide a route to efficiently manipulate the interaction of photons with graphene, which has recently sparked keen interest in graphene plasmonics(2-10). However, the electro-optic tuning capability of unpatterned graphene alone is still not strong enough for practical optoelectronic applications owing to its non-resonant Drude-like behaviour. Here, we demonstrate that substantial gate-induced persistent switching and linear modulation of terahertz waves can be achieved in a two-dimensional metamaterial(11,12), into which an atomically thin, gated two-dimensional graphene layer is integrated. The gate-controllable light-matter interaction in the graphene layer can be greatly enhanced by the strong resonances of the metamaterial(13). Although the thickness of the embedded single-layer graphene is more than six orders of magnitude smaller than the wavelength (<lambda/1,000,000), the one-atom-thick layer, in conjunction with the metamaterial, can modulate both the amplitude of the transmitted wave by up to 47% and its phase by 32.2 degrees at room temperature. More interestingly, the gate-controlled active graphene metamaterials show hysteretic behaviour in the transmission of terahertz waves, which is indicative of persistent photonic memory effects.
入藏号: WOS:000310434600016
语种: English
文献类型: Article
KeyWords Plus: TRANSISTORS; MODULATOR; PLASMONICS; TRANSPORT; DEVICES; FILMS
地址: [Lee, Seung Hoon; Kim, Teun-Teun; Lee, Seungwoo; Lee, Seung S.; Min, Bumki] Korea Adv Inst Sci & Technol, Dept Mech Engn, Taejon 305751, South Korea
[Choi, Muhan; Choi, Hong Kyw; Choi, Choon-Gi] Elect & Telecommun Res Inst, Creat Res Ctr Graphene Elect, Taejon 305700, South Korea
[Liu, Ming; Yin, Xiaobo; Zhang, Xiang] Univ Calif Berkeley, Nanoscale Sci & Engn Ctr, Berkeley, CA 94720 USA
[Choi, Sung-Yool] Korea Adv Inst Sci & Technol, Dept Elect Engn, Taejon 305751, South Korea
[Zhang, Xiang] Univ Calif Berkeley, Lawrence Berkeley Natl Lab, Mat Sci Div, Berkeley, CA 94720 USA
通讯作者地址: Min, B (通讯作者),Korea Adv Inst Sci & Technol, Dept Mech Engn, Taejon 305751, South Korea.
电子邮件地址: bmin@kaist.ac.kr

出版商: NATURE PUBLISHING GROUP
出版商地址: MACMILLAN BUILDING, 4 CRINAN ST, LONDON N1 9XW, ENGLAND
Web of Science 类别: Chemistry, Physical; Materials Science, Multidisciplinary; Physics, Applied; Physics, Condensed Matter
研究方向: Chemistry; Materials Science; Physics
IDS 号: 028PN
ISSN: 1476-1122
29 字符的来源出版物名称缩写: NAT MATER
ISO 来源出版物缩写: Nat. Mater.
来源出版物页码计数: 6