Self-assembly of ordered graphene nanodot arrays - DTU Orbit (02/12/2018)

Self-assembly of ordered graphene nanodot arrays
The ability to fabricate nanoscale domains of uniform size in two-dimensional materials could potentially enable new applications in nanoelectronics and the development of innovative metamaterials. However, achieving even minimal control over the growth of two-dimensional lateral heterostructures at such extreme dimensions has proven exceptionally challenging. Here we show the spontaneous formation of ordered arrays of graphene nano-domains (dots), epitaxially embedded in a two-dimensional boron–carbon–nitrogen alloy. These dots exhibit a strikingly uniform size of 1.6 ± 0.2 nm and strong ordering, and the array periodicity can be tuned by adjusting the growth conditions. We explain this behaviour with a model incorporating dot-boundary energy, a moiré-modulated substrate interaction and a long-range repulsion between dots. This new two-dimensional material, which theory predicts to be an ordered composite of uniform-size semiconducting graphene quantum dots laterally integrated within a larger-bandgap matrix, holds promise for novel electronic and optoelectronic properties, with a variety of potential device applications.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Nanocarbon, Center for Nanostructured Graphene, Aarhus University, IBM Research, Brookhaven National Laboratory
Number of pages: 9
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Nature Communications
Volume: 8
Issue number: 1
ISSN (Print): 2041-1723
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 12.41 SJR 6.582 SNIP 2.912
Web of Science (2017): Impact factor 12.353
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 11.8 SJR 6.414 SNIP 2.855
Web of Science (2016): Impact factor 12.124
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 11.23 SJR 6.287 SNIP 2.86
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 10.77 SJR 6.41 SNIP 3.034
Web of Science (2014): Impact factor 11.47
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 9.85 SJR 6.206 SNIP 2.797
Web of Science (2013): Impact factor 10.742
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 8.32 SJR 5.866 SNIP 2.829
Web of Science (2012): Impact factor 10.015
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Scopus rating (2011): CiteScore 4.44 SJR 3.137 SNIP 1.825
Web of Science (2011): Impact factor 7.396