

The Global Market for Non-Carbon 2D Materials

<https://marketpublishers.com/r/G9994071921EN.html>

Date: April 2019

Pages: 76

Price: US\$ 450.00 (Single User License)

ID: G9994071921EN

Abstracts

Graphene has brought to the world's attention the exceptional properties of two-dimensional (2D) nanosheet materials. Due to its exceptional transport, mechanical and thermal properties, graphene has been at the forefront of nanomaterials research over the past few years. Its development has enabled researchers to explore other 2D layered materials, such as the transition metal dichalcogenides, a wide variety of oxides and nitrides and clays.

Researchers have therefore looked beyond graphene in recent years to other layered 2D materials, such as borophene, molybdenum disulfide (MoS₂), hexagonal boron nitride (h-BN) and phosphorene. These materials possess the intrinsic properties of graphene, such as high electrical conductivity, insulating and semi-conducting properties, high thermal conductivity, high mechanical strength, gas diffusion barriers, high chemical stability and radiation shielding, but crucially also possess a semiconductor band gap. Theoretical and experimental works on these materials have rapidly increased in the past couple of years and they are now commercially available from several advanced materials producers.

Non-carbon 2D materials covered in this report include:

borophene.

molybdenum disulfide (MoS₂).

hexagonal boron nitride (h-BN).

phosphorene.

graphitic carbon nitride.

germanene.

graphane.

graphdiyne.

stanene/tinene.

tungsten diselenide.

rhenium disulfide.

diamene.

silicene.

antimonene.

indium selenide.

Markets these materials could significantly impact and are covered in this report include:

Electronics.

Batteries (Lithium-ion, sodium-ion, lithium-sulfur, lithium-oxygen).

Sensors.

Separation membranes.

Photocatalysts.

Thermoelectrics.

Photovoltaics.

Report contents include:

Properties of non-carbon 2D materials.

Applications of non-carbon 2D materials.

Addressable markets for non-carbon 2D materials.

Non-carbon 2D materials roadmap.

Patent landscape.

Production and pricing.

Profiles of 2D materials producers.

Contents

1 EXECUTIVE SUMMARY

2 RESEARCH METHODOLOGY.

3 INTRODUCTION

3.1 Types of non-carbon 2D materials.

3.1.1 Transition-metal dichalcogenides (TMDCs)

3.1.2 2D oxides

3.1.3 Hexagonal boron nitride

3.1.4 Single element

3.2 Synthesis and production.

3.3 Patent landscape.

4 BOROPHENE.

4.1 Properties

4.2 Applications

4.3 Market opportunity

5 PHOSPHORENE

5.1 Properties

5.2 Fabrication methods

5.3 Challenges for the use of phosphorene in devices

5.4 Applications

5.4.1 Electronics.

5.4.2 Field effect transistors

5.4.3 Thermoelectrics

5.4.4 Batteries.

5.4.4.1 Lithium-ion batteries (LIB)

5.4.4.2 Sodium-ion batteries

5.4.4.3 Lithium–sulfur batteries

5.4.5 Supercapacitors.

5.4.6 Photodetectors

5.4.7 Sensors.

5.5 Market opportunity

6 GRAPHITIC CARBON NITRIDE (G-C₃N₄)

6.1 Properties

6.2 Synthesis

6.3 C₂N

6.4 Applications

6.4.1 Electronics.

6.4.2 Filtration membranes.

6.4.3 Photocatalysts

6.4.4 Batteries (LIBs).

6.4.5 Sensors

6.5 Market opportunity

7 GERMANENE.

7.1 Properties

7.2 Applications

7.2.1 Electronics.

7.2.2 Batteries.

7.3 Market opportunity assessment

8 GRAPHDIYNE

8.1 Properties

8.2 Applications

8.2.1 Electronics.

8.2.2 Batteries.

8.2.2.1 Lithium-ion batteries (LIB)

8.2.2.2 Sodium ion batteries.

8.2.3 Separation membranes.

8.2.4 Water filtration

8.2.5 Photocatalysts

8.2.6 Photovoltaics.

8.3 Market opportunity assessment

9 GRAPHANE.

9.1 Properties

9.2 Applications

9.2.1 Electronics.

9.2.2 Hydrogen storage

9.3 Market opportunity assessment

10 HEXAGONAL BORON-NITRIDE.

10.1 Properties.

10.2 Applications.

10.2.1 Electronics.

10.2.2 Fuel cells.

10.2.3 Adsorbents.

10.2.4 Photodetectors.

10.2.5 Textiles

10.2.6 Biomedical.

10.3 Market opportunity assessment

11 MOLYBDENUM DISULFIDE (MOS₂).

11.1 Properties.

11.2 Applications.

11.2.1 Electronics.

11.2.2 Photovoltaics.

11.2.3 Piezoelectrics

11.2.4 Sensors

11.2.4.1 Filtration.

11.2.5 Batteries.

11.2.6 Fiber lasers

11.3 Market opportunity assessment

12 RHENIUM DISULFIDE (RES₂) AND DISELENIDE (RESE₂).

12.1 Properties.

12.2 Applications.

12.2.1 Electronics.

12.3 Market opportunity assessment

13 SILICENE.

- 13.1 Properties.
- 13.2 Applications.
 - 13.2.1 Electronics.
 - 13.2.2 Photovoltaics.
 - 13.2.3 Thermoelectrics
 - 13.2.4 Batteries.
 - 13.2.5 Sensors
- 13.3 Market opportunity assessment

14 STANENE/TINENE

- 14.1 Properties.
- 14.2 Applications.
 - 14.2.1 Electronics.
- 14.3 Market opportunity assessment

15 TUNGSTEN DISELENIDE.

- 15.1 Properties.
- 15.2 Applications.
 - 15.2.1 Electronics.
- 15.3 Market opportunity assessment

16 ANTIMONENE

- 16.1 Properties.
- 16.2 Applications.

17 DIAMENE.

- 17.1 Properties.
- 17.2 Applications.
- 17.3 Market opportunity assessment

18 INDIUM SELENIDE

- 18.1 Properties.
- 18.2 Applications.
 - 18.2.1 Electronics.

18.3 Market opportunity assessment

19 COMPARATIVE ANALYSIS OF GRAPHENE AND OTHER 2D MATERIALS.

20 TECHNOLOGY ROADMAP

21 PRODUCER PROFILES.

22 GLOSSARY.

23 REFERENCES

Tables

TABLES

Table 1: 2D materials types

Table 2: Applications and addressable markets of borophene

Table 3: Electronic and mechanical properties of monolayer phosphorene, graphene and MoS₂

Table 4: Applications and addressable markets for phosphorene

Table 5: Applications and addressable markets for graphitic carbon nitride.

Table 6: Applications and addressable markets for germanene

Table 7: Applications and addressable markets for graphdiyne

Table 8: Applications and addressable markets for graphane

Table 9: Applications and addressable markets for hexagonal boron nitride

Table 10: Applications and addressable markets for molybdenum disulfide.

Table 11: Applications and addressable markets for Rhenium disulfide (ReS₂) and diselenide (ReSe₂).

Table 12: Applications and addressable markets for silicene.

Table 13: Applications and addressable markets for stanine/tinene

Table 14: Applications and addressable markets for tungsten diselenide.

Table 15: Applications and addressable markets for diamene

Table 16: Applications and addressable markets for indium selenide.

Table 17: Comparative analysis of graphene and other 2-D nanomaterials.

FIGURES

Figure 1: Schematic of 2-D materials

Figure 2: Borophene schematic.

Figure 3: Black phosphorus structure.

Figure 4: Black Phosphorus crystal.

Figure 5: Bottom gated flexible few-layer phosphorene transistors with the hydrophobic dielectric encapsulation.

Figure 6: Graphitic carbon nitride.

Figure 7: Structural difference between graphene and C₂N-h₂D crystal: (a) graphene; (b) C₂N-h₂D crystal. Credit: Ulsan National Institute of Science and Technology.

Figure 8: Schematic of germanene

Figure 9: Graphdiyne structure

Figure 10: Schematic of Graphane crystal

Figure 11: Structure of hexagonal boron nitride

Figure 12: BN nanosheet textiles application

Figure 13: Structure of 2D molybdenum disulfide

Figure 14: SEM image of MoS₂.

Figure 15: Atomic force microscopy image of a representative MoS₂ thin-film transistor

Figure 16: Schematic of the molybdenum disulfide (MoS₂) thin-film sensor with the deposited molecules that create additional charge

Figure 17: Schematic of a monolayer of rhenium disulfide

Figure 18: Silicene structure

Figure 19: Monolayer silicene on a silver (111) substrate

Figure 20: Silicene transistor

Figure 21: Crystal structure for stanene.

Figure 22: Atomic structure model for the 2D stanene on Bi₂Te₃(111)

Figure 23: Schematic of tungsten diselenide

Figure 24: Schematic of Indium Selenide (InSe).

Figure 25: Non-graphene 2D materials roadmap

I would like to order

Product name: The Global Market for Non-Carbon 2D Materials

Product link: <https://marketpublishers.com/r/G9994071921EN.html>

Price: US\$ 450.00 (Single User License / Electronic Delivery)

If you want to order Corporate License or Hard Copy, please, contact our Customer Service:

info@marketpublishers.com

Payment

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page <https://marketpublishers.com/r/G9994071921EN.html>

To pay by Wire Transfer, please, fill in your contact details in the form below:

First name:
Last name:
Email:
Company:
Address:
City:
Zip code:
Country:
Tel:
Fax:
Your message:

****All fields are required**

Customer signature _____

Please, note that by ordering from marketpublishers.com you are agreeing to our Terms & Conditions at <https://marketpublishers.com/docs/terms.html>

To place an order via fax simply print this form, fill in the information below and fax the completed form to +44 20 7900 3970