

# The Global Market For Carbon Nanotubes, Graphene, Quantum Dots and Silver Nanowires in Consumer Electronics

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## Abstracts

Carbon nanotubes, graphene, silver nanowires and quantum dots are all key technologies for next generation consumer electronics applications. They are leading candidates to replace Indium Tin Oxide (ITO) in displays and silicon in transistors. These extraordinary materials have already been integrated into some consumer electronics products and their market penetration will grow over the next decade. ITO replacement is a key theme among product development in displays. Carbon nanotubes, graphene and silver nanowires may allow for the replacement of existing electrically conductive materials that are in short supply, expensive and limited in their use with flexible substrates.

This 187 page report includes:

Market analysis for carbon nanotubes, graphene, silver nanowires and quantum dots in touch panels, displays, conductive inks, and transistors

Applications and estimated time to market

Industry news from 2013-2014

Product developers

Potential market size

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## About

This is a golden era for nanostructured carbon materials research. Graphitic carbon materials such as carbon nanotubes (CNTs) and graphene are the strongest, lightest and most conductive fibres known to man, with a performance-per-weight greater than any other material. In direct competition in a number of markets, they are complementary in others.

Once the most promising of all nanomaterials, CNTs face stiff competition in conductive applications from graphene and other 2D materials and in mechanically enhanced composites from nanocellulose. However, after considerable research efforts, numerous multi-walled carbon nanotubes (MWNTs)-enhanced products are commercially available. Super-aligned CNT arrays, films and yarns have found applications in consumer electronics, batteries, polymer composites, aerospace, sensors, heaters, filters and biomedicine.

Large-scale industrial production of single-walled carbon nanotubes (SWNTs) has been initiated, promising new market opportunities in transparent conductive films, transistors, sensors and memory devices. SWNTs are regarded as one of the most promising candidates to be utilized as building blocks in next generation electronics.

Two-dimensional(2D) materials are currently one of the most active areas of nanomaterials research, and offer a huge opportunity for both fundamental studies and practical applications, including superfast, low-power, flexible and wearable electronics, sensors, photonics and electrochemical energy storage devices that will have an immense impact on our society.

Graphene is a ground-breaking two-dimensional (2D) material that possesses extraordinary electrical and mechanical properties that promise a new generation of innovative devices. New methods of scalable synthesis of high-quality graphene, clean delamination transfer and device integration have resulted in the commercialization of state-of-the-art electronics such as graphene touchscreens in smartphones and flexible RF devices on plastics.

Beyond graphene, emerging elementary 2D materials such as transition metal dichalcogenides, group V systems including phosphorene, and related isoelectronic structures will potentially allow for flexible electronics and field-effect transistors that exhibit ambipolar transport behaviour with either a direct band-gap or greater gate

modulation.

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