

FAQ:

What are the main applications that may drive revenue growth for Nano-C over the next 24 months?

The five main application areas that may drive near term revenue growth for Nano-C are: 1) High sensitivity sensors for mobile phones; 2) Ultra-low power NRAM embedded devices; 3) High-efficiency tandem perovskite solar for residential and commercial applications; 4) Organic Photovoltaic Solar for Building Integrated PV (BIPV); and 5) Extreme Ultraviolet (EUV) Photoresists and Spin-on-Carbon-Masks for the next generation of Semiconductor Manufacturing.

How and why are Nano-C’s innovations relevant to consumers?

Consumers may see the benefit of Nano-C’s innovative materials through improvements in device performance. Here are some examples:

Application	Potential Consumer Impacts
1) High sensitivity sensors for mobile phones.	Speed and ease of use—can open the phone by touching anywhere on the screen and possibly up to 1000x more secure.
2) Ultra-low power NRAM embedded devices.	A phone that lasts for up to 6-months on standby. Potentially 100x increase in speed enable no-lag recall of information.
3) High-efficiency tandem perovskite solar for residential and commercial applications.	Potentially up to 50% more power from the same area, and at the same installation cost as conventional silicon solar cells. Possibly a more economically efficient choice.
4) Organic Photovoltaic Solar for Building Integrated PV (BIPV).	Almost any surface of a building can potentially generate power, including windows.
5) Extreme Ultraviolet (EUV) photo resists and Spin-on-Carbon-Masks for the next generation of Semiconductor Manufacturing.	Potentially increased computing power enabling applications like autonomous vehicles, AI, VR

What value do Nano-C’s materials bring to high-value electronics?

When device makers use nanocarbon additives, it typically improves the performance in one or more of three areas: 1) Potentially increased electrical conductivity; 2) Potentially stronger, lighter mechanically reinforced materials; and 3) Potentially improved thermal performance due to high thermal conductivity.

What is the overall addressable materials market potential for the applications Nano-C is focused on?

As of May 2020, Nano-C estimates that the addressable materials market for their five focal applications is potentially \$5 billion. This is based on market studies on global industry projections for materials required for the semiconductor, solar, memory, and display industries. There are potentially very significant applications in our development pipeline which are not calculated in this addressable market number including: batteries, fuel cells, pharmaceuticals for treatment and prevention, composites, and lubricants.

How does Nano-C make money?

By partnering with its key customers, Nano-C seeks to lock in customers for the long-term by first entering into development relationships that result in value-added materials for the customer and then signing long-term supply agreements. Nano-C believes it can make money by combining high

performance materials that can command performance-based pricing with low cost manufacturing. Potential for profitability over the long-term derives from the ability to “ride the price-volume” curve over time. More information can be found in the Private Placement Memorandum.

Why is Moore’s Law important and how does Nano-C play a critical role?

Moore’s Law is the perception that the number of transistors on a microchip doubles every two years, while the cost of computers is halved. Essentially, it states that we can expect cheaper more powerful chips that increase the speed and capability of our electronic devices without increasing the price. In recent years, this historical trend has been challenged by the limitations of the current semiconductor manufacturing processes and materials. Nano-C enables the continuation of Moore’s Law through its cutting-edge semiconductor materials which include EUV Photoresists and Spin-on-Carbon Hard Masks. Its nanostructured carbon-based materials allow for smaller feature sizes, potentially increasing the number of transistors on a microchip and the power of the chip, while potentially reducing cost. These novel materials also enable ultra-fast, energy-efficient memory by potentially increasing the computing capacity at a reduced cost.

Learn more here (Focal Point, Oct. 2019): [*The Extreme Physics Pushing Moore’s Law to the Next Level*](#)

What is a fullscreen fingerprint sensor / reader?

Cell phone OEMs (Original Equipment Manufacturers) are pushing the industry to “notchless”, edge-to-edge displays with fingerprint sensors built-in under the display. At the same time, they are asking for increased ease-of-use and greater device security. Nano-C provides a potentially key material in the creation of an ultra-sensitive, thin, light photodetector that can be used to read fingerprints in rigid and flexible OLED displays. Current active customer qualification and scale-up are underway targeting major phone manufacturers in Asia.

Learn more here (EE Times, January 2020): [*Multi-Finger Authentication Reinforces Smartphone Security*](#)

What is EUV (Extreme Ultraviolet) Photoresists?

Nano-C is developing photoresists for Extreme Ultraviolet (EUV) lithography to potentially enable finer pitch semiconductor manufacturing. Our partners are targeting major semiconductor manufacturers (e.g., Intel, Samsung, TSMC)). We are working with leading major chemistry suppliers to bring this technology to market. Fab trials are expected to be piloted by major players in 2020.

Learn more here (Focal Point, Oct. 2019): [*The Extreme Physics Pushing Moore’s Law to the Next Level*](#)

What is NRAM?

Non-volatile memory based on carbon nanotubes has the potential to offer a fast DRAM memory replacement with a 40% reduction in power consumption for applications like embedded devices, enterprise storage and mobile devices. Nano-C is in active multi-year development supplying world leading NRAM company Nantero whose long-time investors include Dell, Cisco, Kingston Technologies and Schlumberger. Fujitsu is the first named customer of Nantero with expected launch in 2020.

Learn more here (EE News, April 2020): [*First carbon nanotube NRAM products due in 2020, says Nantero*](#)

How does Nano-C help to potentially positively impact climate change?

We develop advanced materials that may play a critical and enabling role in devices that may possibly have a significant and lasting impact on mitigating climate change. Based on internal estimates, we have calculated this potential as driving a >1800 megatons reduction in greenhouse gases (GHG). By 2050, Tandem PV and OPV devices that use Nano-C materials are projected to possibly drive over 1 billion tons of reduction in CO₂. For perspective, CO₂ emissions in the US were 4.8 billion tons and in Japan 1.1 billion tons in 2016. In our pipeline today, Nano-C is actively engaged in launching products with customers with the following potential:

- *Tandem Perovskite PV: 50% increase in conversion efficiency over silicon*
- *Organic PV (OPV): Allow the walls and windows of buildings to harvest energy*
- *NRAM: Reduce memory power consumption by up to 40% in servers and devices*
- *Sensors: Reduce food spoilage and detect gases which may negatively impact climate change*

What is Tandem Perovskite Solar?

Tandem perovskite solar aims for a 50% increase in solar conversion efficiency out of the same area with potentially no increase in installation costs. The tandem approach to solar panels uses a perovskite layer deposited on top of existing silicon technologies. This specialized layer absorbs different wavelengths of light than the silicon. After absorbing these different wavelengths, remaining light passes through to the traditional silicon cell below. The result is a potential to increase conversion efficiency goes from approximately 20% with traditional silicon to approximately 30% using both silicon and perovskite materials. In addition, this solution aims to be fully compatible with existing manufacturing and installation processes. Nano-C is deeply engaged in joint development and qualification to supply industry leading developers.

Learn more here (IMEC, Nov. 2019): [The 5 things you always wanted to know about perovskite solar cells \(the new hype in PV world\)](#)

What are solar windows and building integrated PV (BIPV)?

Windows are typically used to allow light through. Walls are usually thought to be structural. However, these surfaces are also increasingly being looked at to generate electricity. Today, buildings are responsible for approximately 36% of final energy use worldwide and approximately 28% of global CO₂ emissions. OPV can be translucent or transparent and is highly efficient in indoor ambient light. As recently reported, Bloomberg New Energy Finance indicated that the market for BIPV modules may grow by over 5-times to over \$32 billion over the next 5-years. In addition, from a regulatory perspective in Europe, an EU directive requires that all new buildings as of 2021 must be nearly energy neutral, which is a further driver of BIPV. Fraunhofer ISE (part of one of the leading European research institutes) recently highlighted a 2017 study (focused on Germany) which found that “only 10% of the PV-suitable area on building is needed to transition Germany completely to renewable energy.

Learn more here (Solar Magazine, Feb. 2020): [Transparent Solar Panels: Reforming Future Energy Supply](#)

Learn more here (PV Magazine, Jul. 2020): [Shanghai's Rafael Gallery to host 1 MW of Hanergy modules](#)

What are organic photovoltaics (OPV)?

OPV has the potential for low-cost, printable, low-light efficient solar solutions being integrated into buildings (BIPV), windows, and IoT devices. This may enable much of the built and mobile world to

harvest the sun's energy. OPV can be fully "building integrated" by harvesting light through windows, installed on interior walls, or applied to any external vertical surface. Compared to silicon-based devices, organic solar cells are lightweight (important for autonomous IoT sensors), potentially disposable and inexpensive to fabricate, flexible, customizable and may have less adverse environmental impact. Nano-C is shipping to commercial customers with additional customer validations and field trials underway for a high performance OPV active layer. Nano-C is working with leading companies in Europe and South America.

Learn more here (Heliatek, Dec. 2019): [Heliatek Corporate Video \(BIPV\)](#)

Learn more here (TED Talk, Dec. 2017): [TED Talk A Printable, Flexible Organic Solar Cell](#)

What is nanostructured carbon?

Carbon is a non-metallic chemical element often regarded as a common element of all known life. It is the 15th most abundant element in the Earth's crust, and the fourth most abundant element in the universe by mass. Found in many forms, nanocarbons can be in flat 2D sheets called graphene, or spherical tubes called carbon nanotubes, as well as fullerenes; a spherical, closed-cage structure also called buckminster fullerene, or "buckyballs."

Nano-C focuses on creating advanced materials based on fullerenes and carbon nanotubes.

What is a fullerene?

- A fullerene is a third form of carbon along with graphite and diamond that features unique properties that make it ideal for photo-resists, organic photovoltaics, spin-on carbon hard masks and organic photo detectors. Their discovery in 1985 was rewarded with a Nobel prize in chemistry 10-years later. Their unique geometric shape—similar to Buckminster Fuller's geodesic dome—led to their being named "Buckminsterfullerenes." Fullerenes unique properties enable a range of application from electronics to medicine because they: Can behave as superconductors through to semi-conductors ▶ Are exceptional radical scavengers ▶ Feature extreme durability ▶ Can be easily modified to tailor properties as a Derivative, enabling modification to their electronic structure, solubility and physical properties.

What is a Carbon Nanotube?

- Considered one of the strongest materials known to man (American Chemical Society, Sep. 2010), carbon nanotubes possess unique structural and electrical properties that make them ideal for a wide variety of applications. Carbon Nanotubes come in two principal forms, single-walled carbon nanotubes (SWCNT) and multi-walled (MWCNT). Although not a hollow tube, carbon nanofibers (CNF) represent a third type of tubular structure. SWCNTs have unique properties that make them a vital foundation for advancing device performance because they: ▶ Behave as a semi-conductor or metal ▶ Are stronger than steel, yet lighter than aluminum ▶ Conduct heat most efficiently ▶ Can easily be modified to tailor properties as an "Ink."

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