

# Lab tests show ZEN Graphene's virucidal ink 99% effective against COVID-19; patent applied for

## Optimization, production scale-up and commercialization planned

Another month deeper into the global COVID-19 crisis and the world is still looking for effective tools to combat the pandemic. Virus testing is still both not widespread nor accurate enough, and a vaccine still eludes us. Governments and businesses are grimly contemplating the consequences of a second (or is it the third or fourth?) wave and the potential for another economy-crippling, government-sanctioned lockdown. In the meantime, we are all looking for ways to avoid the virus and keep ourselves healthy.

On September 22, 2020, ZEN Graphene Solutions Ltd. (TSXV:ZEN | OTC:ZENYF) announced that after 5 months of optimization, it has **developed and successfully tested a novel graphene-based virucidal ink with 99% effectiveness against COVID-19**. The ink, used as a coating or protective layer on masks and other PPE, was shown to be 99% effective against the COVID-19 virus and significantly was **still 99% effective a minimum of 35 days after application** to N95 mask material. The company is now developing plans to expedite commercialization of this product, pending regulatory approval, and has filed a provisional patent for this graphene-based virucidal product and is beginning antibacterial and antifungal tests utilizing its proprietary virucidal ink formulation.

ZEN Graphene followed up this announcement with more news on

September 28, 2020 that the University of Guelph has filed a **provisional patent** regarding an electrochemical exfoliation process to produce graphene oxide (GO) from Albany Pure Graphite. The exfoliation method is designed to be a scalable, low cost, low energy and environmentally friendly method of producing graphene oxide, a key ingredient in ZEN's proprietary virucidal ink.

A virucide is any physical or chemical agent that deactivates or destroys viruses. This differs from an antiviral drug, which inhibits the proliferation of the virus. Virucides are not intended for use inside the body, but they are effective on surfaces outside the body.

In the recent results from Western University's ImPaKT facility Biosafety Level 3 laboratory, two ZEN Graphene graphene-based ink samples at different concentrations were applied to N95 mask filtration media and then exposed to the SARS-CoV-2 virus that causes COVID-19 and tested for antiviral properties. Very significant virucidal activity was recorded and reported, **achieving 99% inactivation of the virus** for both samples in 3 separate tests each and verified through a second round of testing. Of significance, the antiviral effect of the second round of testing was on material that was prepared 35 days earlier demonstrating the ongoing virucidal activity of ZEN's proprietary ink.

The research and development of this antiviral ink formulation was conducted entirely by ZEN's research team at its Canadian facility using a graphene product that was **produced from its Albany mine graphite**.

The significance of the ZEN Graphene virucidal ink is based on the physical characteristics of graphene. Graphite flakes extracted from the ZEN Albany mine in Ontario to convert to graphene are approximately 9 microns (9,000 nanometers) making conversion to graphene very cost effective. Graphene is 200 times stronger than steel, conducts heat 10 times more than

copper and conducts electricity 1,000 times better than copper according to ZEN Chairman and CEO Dr. Francis Dubé.

In other words, you soon could be wearing a mask with the ZEN virucidal ink on it and would not know the difference between that and a non-coated mask. Except to know that you are now actually wearing something that actually kills the coronavirus as it passes through your mask.

There are still multiple steps for ZEN to go through before the virucidal ink is publicly available on personal protective equipment, but this is a big step forward towards commercialization as technology brings society closer to a coronavirus solution. In the meantime, ZEN intends to continue to move rapidly towards optimization, production scale-up and commercialization of its graphene-based ink.

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## **Scaling up graphene production to meet forecast demand, ZEN Graphene shares double since April**

In recent years we have heard that graphene can be the next super material due to its immense strength and electrical conduction properties. The next step is for large scale, low cost, graphene production to occur so as to supply the market demand. It looks like graphene's time has now come.

A 2019 Canaccord UK research report estimated worldwide graphene sales were likely to take off over the next few years reaching US\$4.8 billion by 2030, growing at a CAGR of 45%.

That is a huge forecast demand increase, effectively forecasting in the next 2 years graphene demand will double, then double again, and so on.

## Graphene – Properties, Facts, and Applications

Properties	Facts	Applications
Strength	200 x stronger than steel	Composite materials & alloys - rubber, plastic, aluminum & concrete
Flexibility	Can bend & stretch to 120% of original size	Coatings, additives & wearable technologies.
Thermal Conductivity	10 x conductivity of copper	Composite materials - concrete, coatings, polymers etc.
Impermeability	Hydrogen atoms cannot penetrate its structure	Filters, water purification, gas storage and hydrogen fuel cells
Electrical Conductivity	1000 x current capacity of copper	Longer battery life, semiconductors
Electronic behaviour	Electrons can move at near light speed through it	Improved speed / efficiency for computer chips
Optical Properties	Allows more light through than glass	Thinner, lighter screens and transparent tensile coatings

### Source

One company is currently scaling up their graphene production from their new facility in Canada to meet what should be extremely strong demand this decade. That company is ZEN Graphene Solutions Ltd. (TSXV: ZEN) (“ZEN”).

ZEN is an emerging graphene technology solutions company with a focus on the development of graphene-based nanomaterial products and applications. ZEN sources its graphite to make graphene from its ‘unique’ Albany Graphite Project. I say unique because independent labs in Japan, UK, Israel, USA and Canada have independently demonstrated that ZEN’s Albany Pure™ Graphite is an ideal precursor material which easily converts (exfoliates) to graphene using a variety of methods.

Some of the numerous applications for ZEN’s graphene include:

- **Aerospace and aircraft** – Graphene coatings that can greatly improve corrosion resistance, reduce friction and can be hydrophobic reducing ice formation. Graphene

composites also help to increase strength and flexibility while potentially reducing overall weight.

- **Fuel Additive** – Graphene oxide in diesel/jet fuel improves fuel economy and reduces greenhouse emissions.
- **Electromagnetic shielding** and electrostatic dissipation.
- **Desalinization membranes** and low-energy dehumidification.
- **Heavy metal scavenging** –Graphene quantum dot/nanocellulose membranes are a recyclable material capable of removing industrial contamination.
- **Photovoltaics, displays, biomedical applications** using graphene quantum dots. Graphene based virucidal inks embedded in protective clothing to fight COVID-19 are another useful application right now.
- **Material enhancement** using graphene. Graphene is also useful to boost tires strength and performance as well as a concrete additive to boost performance. Graphene can also be used to strengthen clothing for military applications. Graphene also strengthens aluminum, rubber, plastics and other materials.
- **Hydrogen storage and production** – Graphene is an ideal catalyst for water splitting (10x more efficient than platinum catalysts) and can store hydrogen in a solid state.
- **Advanced batteries** –Anode energy densities are 1500mAh/g in graphene-enhanced aerogels and 840mAh/g with reduced graphene oxide. Graphene has greater conductivity and improves cold weather performance. Samsung is developing an advanced graphene phone battery.

## **ZEN Graphene Solutions Guelph, Ontario facility is scaling up graphene production in 2020**

The Guelph graphene facility opened in March 2020 and is now scaling up graphene production to sell to the many potential buyers as discussed above.

## New Guelph facility - next phase of development & scale up



- Grand Opening March 3, 2020
- Access to 2,000 Square Foot Lab Space
- Small-scale graphite purification & graphene production facilities
- E-commerce Store Launch February 27, 2020
- Graphene products available for R&D and commercial use

### Source

In addition to ZEN's Guelph facility ramping up production, ZEN announced in July 2020 a new partnership with Evercloak and NGen for a 'Graphene in Cleantech Manufacturing Project'. The announcement states:

"The project entitled "Advancing Large-Scale Graphene and Thin-Film Membrane Manufacturing" will support the scale up of graphene oxide (GO) production by ZEN to supply GO to Evercloak for their scale up and optimizing activities."

For ZEN this is another significant endorsement and step forward along the pathway of commercializing their graphene. Evercloak is commercializing a manufacturing platform for producing continuous, large-area, monolayers of exfoliated 2D nanomaterials, including graphene, graphene oxide, molybdenum disulfide, and carbon nanotubes. These films are increasingly used for a wide range of applications such as energy storage, smart packaging, electronic devices, corrosion inhibitors, and membranes. Evercloak's initial focus is on manufacturing graphene-based membranes for dehumidification to significantly reduce the energy use and associated greenhouse gas related with building cooling.

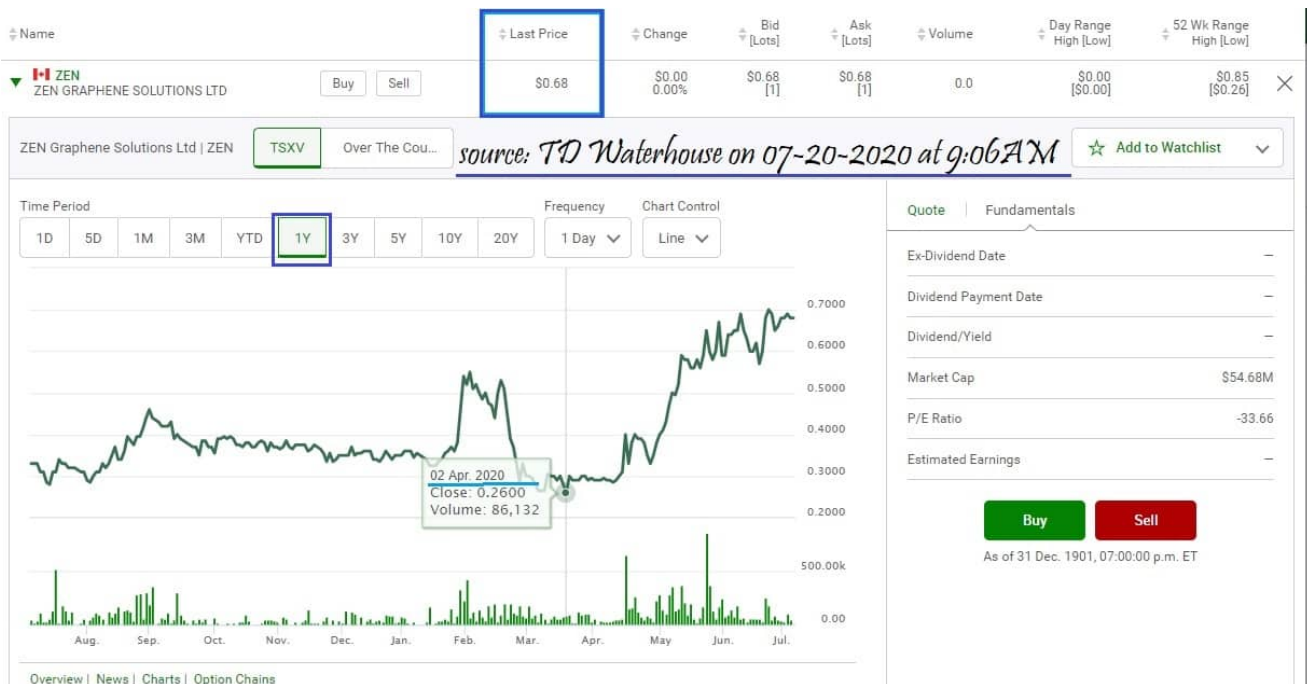
ZEN's CEO Francis Dubé commented: "ZEN is pleased to support Canadian graphene-based innovations and Evercloak is a wonderful example of what can be achieved with nanomaterials and Canadian entrepreneurship. NGen supports the accelerated development of high potential technologies such as our graphene collaboration. We look forward to helping Evercloak bring breakthrough technology to everyday life."

### **Closing remarks**

Success in the manufacturing sector is about collaboration with your supply chain. ZEN continues to win interest in their graphene products and continues to develop a supply chain, on this latest occasion with Evercloak.

A recent C\$2 million capital raise means ZEN has cash to accelerate their near term expansion activities, which will include funds for the Albany Graphite Project, further graphene research, graphene production scale up, COVID-19 initiatives, and other graphene applications development. Also the recent engagement of Hybrid Financial to help market ZEN should boost the number of eyes on the stock.

Combine the above with continuing commercial success selling graphene products and 2020 should see a successful year for ZEN. Late 2020 and 2021 should start to see revenues coming in and a lot more interest in both graphene and ZEN Graphene Solutions. Despite the stock price more than doubling since April 2020, the stock still looks reasonably priced trading on a market cap of C\$57 million.



# ZEN Graphene's Dr. Dube on making graphene, the 'new wonder material' on an industrial scale

In an InvestorIntel interview during PDAC last week, Tracy Weslosky secures an interview update with Chairman, CEO and Director Dr. Francis Dube on ZEN Graphene Solutions Ltd. (TSXV: ZEN), an emerging graphene technology solutions company with a focus on the development of graphene-based nanomaterial products and applications.

Dr. Dube started, "Graphene is a new wonder material. It is 200 times stronger than steel, conducts heat 10 times more than copper. Conducts electricity 1000 times better than copper." He continued by saying that graphene can be produced



by breaking graphite in layers or by a process called Carbon Vapor Deposition (CVD). The CVD process is very costly. With the graphite deposit at the Albany project, ZEN Graphene can make graphene on an industrial scale with industrial pricing. ZEN Graphene has also launched a webstore, first in Canada, to sell its Albany Pure™ graphene products. He also provided an update on the grand opening of a facility at Guelph University. The facility was opened on March 3, 2020, and will be used for graphene materials production and development.

To access the complete interview, [click here](#)

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