Graphene - Could it change everything?

Imagine a material that has these characteristics:

- A one-atom thick sheet sufficient to cover a soccer field would weigh less than a gram;
- Is the strongest material in nature at roughly 200 times the strength of structural steel;
- Can be included in composite materials that are ten times tougher than Kevlar;
- Can be used to make memory chips and transistors allowing electrons to move faster than silicon;
- Could significantly lower the cost of display screens that could be flexible, stretchable and transparent;
- Be used as a ten times more accurate sensor for disease and gas detection;
- Be used in ultra-capacitors that may be able to have as much or more storage capacity as lithium ion batteries though recharge in minutes, and last three times as long;
- Could be used as the world's thinnest anti-corrosion coating; and
- Can allow plastics to conduct electricity.

We could go on with many more applications for Graphene as scientists are coming up with additions to add to the list almost daily. Around the world there are approximately 200 companies with some involvement in Graphene, however outside Graphite miners pure Graphene stock market investment opportunities are relatively limited at this stage.

Companies such as Samsung have made prototypes of 25-inch flexible touch screens using Graphene, and other large companies such as IBM and Nokia are also involved, while smaller US listed companies such as CVD Equipment Corp. (CVV) are producing specialised Graphene products.

While Graphene is expensive at the moment, technology and production techniques are developing rapidly and this is likely to reduce costs.

Graphene is being made mostly by using Graphite as a base, however companies such as unlisted Graphene Technologies in the US are now making Graphene out of carbon dioxide. Yes, an abundant waste product.

Commercial applications must be years away, right? No, products will be coming on the market in 2013/14. While these will be specific application products to begin with, this is likely to only be the start for a material that may be the most important innovation since plastic.

If it lives up to its promise Graphene really could change everything...well alright, almost everything...

What is Graphene?

Graphene is a single atom layer of carbon atoms in a hexagon chain, a little like honeycomb or chicken wire. This arrangement makes the material particularly strong, despite being so thin that three million layers would only be a millimetre thick, and enough layered together to the thickness of plastic cling film could in theory hold an elephant. Although, we doubt it would stay still while it was being wrapped.

Graphene was theorised around the time of World War II, but it took scientists Andre Geim, and Konstantin Novoselov to isolate the material and in so doing win the Nobel Prize in Physics in 2010.

Of course it must be very complex to isolate one atom thick layers of carbon? Well not exactly, the two scientists did so using ordinary sticky tape pressed against ordinary Graphite, the same material in the pencil on your desk. Yes, and you thought the road to a Nobel Prize lay further away than your 2B pencil and sticky tape dispenser.

Investment ramifications

Some years ago I gave a lecture at a university and part of my talk suggested that in the future everyone in developed countries would have access to large, flat-screen TVs. At the time nothing was on the market, the products were just on the horizon.

This was rather aggressively pointed out by the following lecturer, a person from the mining industry, who said large, flat-screen TVs would be too heavy and would cost $20,000 each. He was correct, when they first came out they were heavy and they were $20,000 each, there was only one problem with his view, today everyone does have access to large, flat-screen TVs.

For some reason many people fail to realise the pace of technological development, and even the cost curve as large numbers of almost anything are produced.

The rise and rise of composite materials

Even though it is early days the applications for Graphene look impressive, sufficient that the Metals and Mining, Crude oil, Electronics and Auto-industries, to name just four industries, should not be complacent.

While not composed of Graphene the latest Boeing 787 Dreamliner passenger jet is composed primarily of composite materials, the first major commercial jetliner to be made in this manner. Even if Graphene is never used in a structural material, and this is unlikely given it is 200 times stronger than steel and very low in weight, the Metals and Mining industry should be taking more notice of the increase in composite material used in structural systems.

New composite materials combined with nanotechnologies are starting to look impressive. While they are not a short term threat, do not assume the Materials or the Energy sectors will be guaranteed paths to wealth for your children, or for Australia in future decades. In fact, perhaps we should

get some resources out of the ground while they are still worth something instead of assuming all metals and Crude oil reserves are heritage asset of value in the long term.

Electronics of all kinds could be dramatically changed by Graphene. Consider a mobile phone that can be folded up or thrown against a wall without damage, rapid miniature computers and credit cards holding as much information as an iPhone, plastic that could conduct electricity, transparent solar cells that double as windows, and batteries that charge ten times faster and last three times as long.

The end of the "Oil Age"

From an investment point-of-view in coming decades it will probably be a better bet to bank on Crude oil obsolescence than Peak oil (i.e. Crude oil depletion). We are probably living through the tail end of the "Oil Age" a period of pretty dirty cities polluted by the internal combustion engine.

Battery technology develops very quickly, remember the first large mobile phones, battery technological application in the Auto-industry is likely to be dramatic in the future and this could have major implications for both the Auto and Crude oil industries.

Early studies in the application of Graphene to existing battery technologies are showing potential for considerable extensions to battery life and reductions in charge time. Even without Graphene some technologies are showing extensions to electric car distances, perhaps sufficient to extend an electric car's between charge range to over 400kms.

Do that on a big enough production scale to reduce costs and it is all over for the internal combustion engine and the Crude oil industry. Plastic and resin use make up less than 5% of petroleum consumption. Battery costs are currently estimated to be declining by 8% per year. The three big drawbacks for electric cars, cost, charge time, and distance between charge are rapidly being solved. Electric cars are already faster off the mark than internal combustion engine cars.

Consider the many economic ramifications of this change to electric cars, from the US trade deficit consisting considerably of Crude oil imports, to a decline in certain types of metal demand, to the decline of Middle East wealth, to employment changes. For a start do not encourage your children to become car mechanics, the car breakdown of the future could be solved by unbolting the old and re-bolting in the new electric engine in five minutes.

Although there may be losers from Graphene and the move away from Crude oil, there will also be winners in the Resources field potentially in graphite, rare earths, lithium and some composite metals. Although, even these products will be subject to rapid technological change risk. It will likely be worth keeping in mind the potential technological threats to the current economic status quo, and starting to position part of an existing portfolio for the post "Oil Age".

Rethink your assumptions

One of the most important investment abilities in the future will be the ability to rethink your assumptions as whole industries build up and disappear more rapidly than ever before. With the exception of some sectors like Property, the long term, set and forget investment will be over.

Consider the economic changes in the world as formerly valuable substances diminish in value and others take their place. There will be very little industry security as technological application changes very rapidly.

The future of investment is going to be extremely exciting, as is your children's future. The cities of the future are likely to be cleaner and quieter. It is going to be a future to be optimistic about, one where you may end up glad your children honed their reaction and decision skills through hours of playing computer and video games.

Of course there will be plenty of doubters about the changes to come, but rather than argue with those views we suggest you go and watch your large, flat-screen TV.

Disclosure: The writer owns shares in Archer Exploration (AXE) a graphite explorer.

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