Graphene Oxide from graphite helps cancer imaging

The latest use for graphene oxide in the fight against cancer is by helping image cancerous tissue with state of the art medical scanners. Read on to find out more…

Diagnosis

The first stage in treating cancer is to diagnose the presence of cancerous cells. Positron Emission Tomography (PET) is a powerful clinical imaging technique that is widely used for diagnostic applications in clinical oncology, owing to its unrivalled sensitivity and quantitative accuracy. It can identify body changes at the cellular level and could detect the early onset of cancer before other tests.

How cancer cells are detected

Cancerous cells grow faster than normal cells and because of this they have to take in growth materials faster than surrounding tissue. Add a material that you can trace and it will accumulate in the cancer tissue. [This is called the enhanced permeability and retention (EPR) effect]. The tracers used are typically radioactive elements such as oxygen fluorine, carbon or nitrogen that have very short half-lives. This means the radioactivity only lasts a short amount of time.

A camera for cancer

PET imaging works when a positron-emitting source is placed in the body. A commonly used source is radioactive fluorine, ^{18}F that is used in very small amounts. The source emits a positron, which immediately interacts with surrounding tissue and produces a pair of gamma photons. These gamma photons pass right through the body and enter a detector that surrounds the body. The detector contains scintillation crystals that turn the gamma photons into light. The light can be detected by a camera. This processes the data into a three dimensional image of the tumour. You can read more about the technique here.

How graphene oxide helps

A team in South Korea published a paper a few days ago titled 'Nano-graphene oxide composite for in vivo imaging'. Nanoplates are just the right size to enter cells and carry other materials with them as we reported recently. The team made graphene oxide nanoplates from very fine quality graphite.

Then they made a nano-composite by adding a water-soluble polymer called PEG-NH_2. This made the nanoplates more biocompatible and helped the nanoplates disperse better. Finally they reacted this nano-composite with the radioactive fluorine to make it a nano-carrier for ^{18}F, this is called radiolabelling.

The team found that the radiolabelled GO nanocomposite 'exhibited excellent stability in various physiological solutions, including DI water, PBS, and cell medium'. They went on to say 'The 18F-labeled nGO-PEG exhibited a high radiolabeling yield'.

So what does this all mean?

The graphene oxide nanocomposite is a very stable material in the body, it disperses well and because nanoplates have a high surface area it can carry a high density of the tracer. This means that the imaging camera receives a better signal and it can image the cancer better. The team actually tested this in a laboratory animal with cancer and found 'A strong PET signal was observed at the tumour site'

If we put this research together with the findings from our last column entry, we can predict where this technology is going. As well as making a swiss army knife to fight cancer, graphene oxide nanoplates will enable high-resolution real time images of the cancer treatment doing its job – precisely where it is needed.

If your company can produce very high quality, high purity graphene oxide nanoplates, then you just might be witnessing a new market opening up…