Sensing implant wear using nanocomposites

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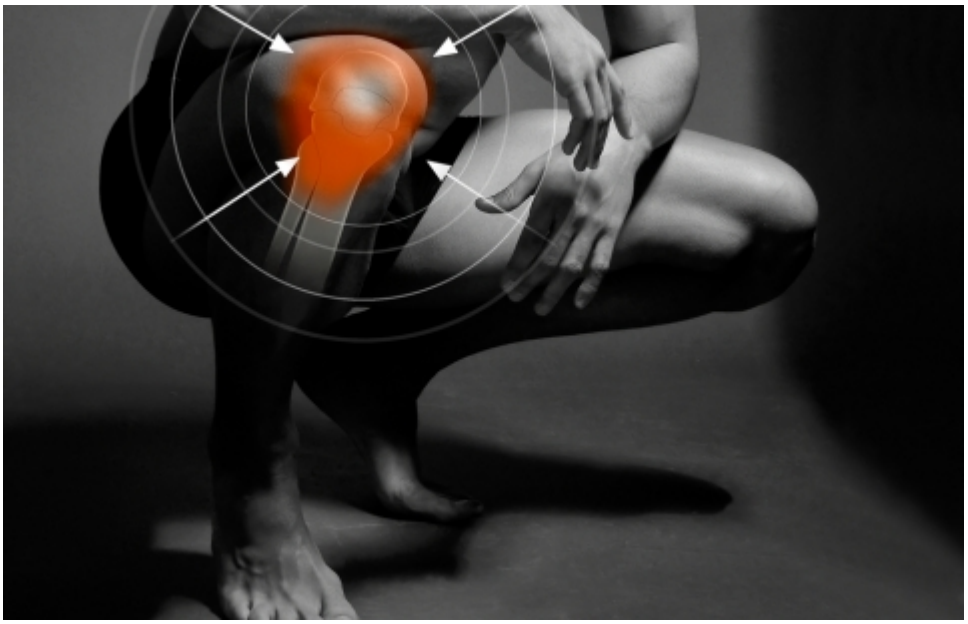
A nanocomposite sensor material for orthopaedic implants that monitors stability, stress and any signals of implant failure.

INVENTION NUMBER: 13_2790



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UNSW researchers have developed a new **nanocomposite** based sensor technology for use in orthopaedic implants to detect stresses, wear and damage in implant joints.

The technology allows existing industry standard polymer materials to be modified slightly with nanocomposites so that they change their electrical resistance in response to stress. The signal can be analysed to measure the stress and wear on an implant over its lifetime. A change over time in the stress distribution can be used to indicate abnormal wear in the implant.

This new material is as strong as existing polymer implant materials and does not require embedded components which can reduce the implants lifespan..

The sensor technology has been tested in the lab and is ready for a collaborative research and development project to produce and test a commercial prototype. UNSW is seeking a partner in the medical device and orthopaedics industry to help further develop the sensor technology within existing implant designs.

Key Benefits

- Provides in situ sensing of strain within knee implants for long term monitoring
- Uses a solid sensor material based on current implant socket materials. This avoids the creation of weak points which may cause implants to fail.
- Based on using existing industry standard materials as the sensor
- The new material is biocompatible and as strong as existing polymer implant materials.

Potential Applications

- Monitoring of joint wear over time.
- Feedback on load distributions during implantation of prosthetic joints
- Knee, hip and other implants
- Other industrial sensing applications where a polymer material is under stress.

Scientific Specifications/Technical Data

Piezoresistive nanocomposite as an embedded stress sensor in instrumented knee prosthesis.

Quyen Do, O'Byrne S, Perriman D, Smith P.

We characterize the electrical properties of a biocompatible nanocomposite which will be used as a stress sensing material in an instrumented knee implant. The composite is fabricated from multi-walled carbon nanotubes and ultra high molecular weight polyethylene. Experimental cyclic compression loading shows that the composite's resistance exponentially decreases with increasing compression stress, proving its potential for application as a piezoresistive stress sensing material. An analytical model is built to estimate the optimal depth from the tibio-femoral contact surface at which an embedded stress sensor could achieve the highest stress resolution and lowest distortion energy inside the tibial insert.

More information on the sensors and their material properties can be found here >>

The Opportunity

This technology is available for free as an Easy Access Licence. UNSW is seeking a partner to license this technology or to work with the researchers to further develop this technology.

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