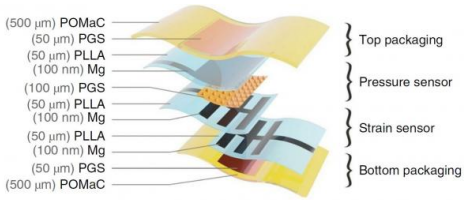
Biodegradable sensor monitors tendon healing

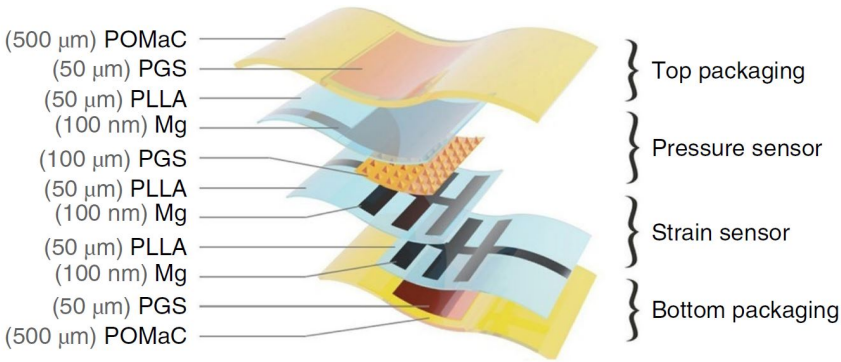
May 21, 2018 // By Julien Happich



Using stretchable bio-compatible and biodegradable polymers as well as hydrolysable magnesium for the metal electrodes, researchers from Stanford University and the University College London have devised a dual strain and pressure sensor which could be implanted upon reparative surgery, to monitor tendon healing.

They argue that by monitoring in real-time the mechanical forces on tendons after surgical repair, physicians could literally customize rehabilitation protocols for the patient's needs, finding the exact balance between active exercises and immobilization for speedier recoveries while avoiding rehabilitation-related injuries.

In a paper titled "A stretchable and biodegradable strain and pressure sensor for orthopaedic application" published in Nature Electronics, the team led by Zhenan Bao proposes a laminated structure encompassing a capacitive strain sensor (two thin film comb electrodes sliding relative to each other) and a thin, flexible capacitor featuring a specifically designed micro-structured elastic dielectric layer for the pressure sensor.



The biodegradable strain and pressure sensor, a laminated stack comprising biodegradable elastomer PGS used as a dielectric layer for the capacitive pressure sensor and as a stretchable non-sticking layer in the strain sensor, allowing the electrodes to slide relative to each other. Soft stretchable and biodegradable elastomer POMaC is used for the strain sensor and packaging, while PLLA is used as the substrate layer for the magnesium electrodes.

For the flexible part, the researchers used two biodegradable elastomers poly(glycerol sebacate) (PGS) and poly(octamethylene maleate (anhydride) citrate) (POMaC) initially developed for tissue engineering applications inside the body and known for their biocompatibility upon degradation, when body fluids eventually permeate through the sensor packaging. The electrodes are made of Mg evaporated on top of a biodegradable polymer substrate (PLLA). Upon hydrolysis, metal magnesium forms highly soluble magnesium oxides that can be evacuated naturally.

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