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Development of Pressure sensing Particles through SERS and Upconversion RYAN WIDEJKO, Francis Marion University, FENGLIN WANG, JEFF ANKER, Clemson University — With the increasing distance of space travel, there is a critical need for non-invasive point-of-care diagnostic techniques. According to the NASA Human Research Roadmap, the "lack of non-invasive diagnostic imaging capability and techniques to diagnose identified Exploration Medical Conditions involving internal body parts," is a critical capability gap for long distance space travel. To address this gap, we developed a novel technique for non-invasive monitoring of strain on implanted devices. We constructed a prototype tension-indicating washer with an upconversion spectrum that depended upon strain. The washer was made of a polydimethylsiloxane (PDMS) mixture with upconversion particles embedded in it. This mixture was cured onto a lenticular lens. Methylene blue dye solution was sealed between the lenticular lens and PDMS so that pressure on the washer displaced the dye and uncovered the upconversion particles. We also began work on a tension-indicating screw based upon surface enhanced Raman spectroscopy (SERS). Future work for this project is to quantitatively correlate the spectral intensity with pressure, further develop SERS washers, and construct SERS and/or upconversion screws or bolts. Non-invasive tension-indicating devices and techniques such as these can be applied to orthopedics, used as a general technique for measuring micro-strain, verifying proper assembly of equipment, and observing/studying bolt loosening.

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