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Flexible, Stretchable, Wearable and Improved Dielectric Materials for MRI

MRI is an important non-invasive imaging modality that produces detailed images of organs and tissues in a body. Using high fields, 1.5T, 3T, 7T, and above, provides higher signal-to-noise ratios (SNR), temporal resolutions and spatial resolution. However, there is also an increased presence of abnormally bright and dark areas, referred to as dielectric artifacts, which degrade the quality of the images. These dielectric artifacts occur because the Larmor frequencies at high field levels involve radiofrequency (RF) wavelengths similar to the scale of the body which results in local RF field (B1) inhomogeneity. Dielectric pads have been recently introduced as a mechanism to aid in uniformly increasing RF transmission into a subject and reduce dielectric artifacts. Unfortunately, current dielectric pads are suboptimal because of positioning issues, pad shapes causing arbitrary RF field distribution, pad visibility in the resulting images, tissue conformity issues, degradation over time, the inability to adapt to different RF loading conditions and a host of other issues.

Prof. Sung-Min Sohn, at Arizona State University, has developed novel dielectric materials and devices that are more predictable and tunable to reduce dielectric artifacts and allow improved MR imaging. The materials are MR invisible, flexible and stretchable and uniformly increase the local magnetic field in MRI. Pads made with these materials conform to different shapes and sizes, decrease the electromagnetic (EM) sensitivity, and reduce inhomogeneity caused by the movement of the pads. In 7T MR imaging tests with a single channel surface coil and phantoms, an improvement of 44 and 33.8% in the signal intensity was observed, as was an improvement of 27.7% and 29.9% in field uniformity. The use of the materials in oxtail imaging with a transceiver volume coil showed an improvement of SNR by 8.7% and 7.2% respectively.

These flexible, stretchable and MR invisible dielectric materials increase MR signal intensity and uniformity and can be easily adopted for clinical applications.

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Potential Applications

- Improved MR Imaging, and replacing current patient positioning sponges and cushions

- 1.5T, 3T, 7T, and beyond

Benefits and Advantages

- Predictable and tunable
- Reduce dielectric artifacts to improve MR imaging
- Invisible, flexible and stretchable
- Conform to different shapes and sizes
- Decrease local EM sensitivity
- Reduce inhomogeneity caused by the movement of the materials
- Increased patient convenience and comfort with these novel dielectric materials

For more information about the inventor(s) and their research, please see

Dr. Sohn's departmental webpage

Dr. Sohn’s laboratory webpage