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CNT-based composite to eliminate Chemical shift error in simultaneous PET/MRI

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Simultaneous PET/ MRI scanner provides both anatomical and functional properties of malignant tissues concurrently, while avoiding uncertainty exists in sequential PET/MRI system. Electromagnetic interference (EMI) between two scanners is a big challenge which restricts both scanner performance and distorts the image quality of each modality.
Although metals have excellent radio-frequency shielding properties to block the EMI, they are not a good candidate for shielding in presence of switching magnetic fields of MRI. Indeed, based on the Faraday's law, variations of magnetic field induce eddy currents in any metallic layer, which have negative impact on the MR image quality and produce the chemical shift error. Thus, there is a huge demand for a new shielding material without inducing eddy currents.
We have extensively investigated the effects of gradient switching in different frequencies from 10 kHz to 100 kHz) and with diverse pulse shapes on particular conductive material to find out the viable candidate for PET/MRI application. To estimate the eddy current in each conductive layer, a custom-made eddy current measurement set-up was fabricated, which evaluates the amount of induced magnetic field by monitoring the variation in voltage at the set-up. A layer of copper, aluminum, carbon fiber, graphene and CHO-SHIELD® 2056 paint were examined. Although the results for eliminating eddy current from paint and graphene were astounding, we could still observe variation in voltage less than 0.7%. Therefore, we fabricated a new composite based on carbon nanotube (CNT) to have control over the shielding layer properties. The CNT based composite provides enough conductivity (about 1E5 S/m) to eliminate the low frequency gradient switching interferences and its network shaped structure prevents the induction of eddy currents in our measurement set-up

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