University of Central Florida

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Material Reduces Electrical Conductivity in MRI, Sensor, and Energy Applications

Induction heating occurs when eddy currents heat conductive material due to the inherent electrical resistance. The traditional use of a highly conductive metallic material slightly reduces induction heating by reducing the amount of energy introduced into the material via the skin effect, but the resulting induction heating may still be too high for certain applications. For example, MRI-induced induction heating, which is more severe at metal tips, causes thermal damage to tissues of patients wearing implants that have leads, such as in spinal fusion stimulators, cardiac pacemakers, and neurostimulation systems. Thus, there is a need for a material that has better biocompatibility and electrical resistivity.

Technical Details

UCF researchers have invented a new material and processing technique to reduce electrical conductivity and eddy currents by making the surface frequency selective. The invention contains a substrate material with an outer surface and a modified surface layer, comprised of the substrate material plus a metal or metal alloy.

Within medical applications, surface modification results in a more reflective, electrically resistive surface of medical components including medical implants (e.g. the lead wire of a pacemaker) and medical tools (e.g. needles, knives, tongs), reducing induction heating that occurs in rapidly time-varying electromagnetic fields in MRI and magnetic resonance tomography (MRT). This material also provides enhanced MRI visibility for implants including stents and bone-repairing fixtures by reducing the blurring that occurs near metallic objects.

In other applications, including sensors, detectors, and energy-related applications, this technique can be used to modify surfaces to selectively increase absorption in electromagnetic waves within particular wavelengths and to boost energy efficiency. This invention includes a frequency selective surface (FSS)-based metamaterial containing modified surfaces that are arranged to create a resonant frequency.

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Keywords

electrical conductivity, MRI, induction heating, electromagnetic fields

Benefits

- Enhanced absorption
- Increased energy efficiency
- Enhanced MRI visibility
- Reduced MRI-induced induction heating

Applications

- Medical applications and components in MRI environments
- Sensors
- Detectors
- Energy production
  - Solar cells
  - Energy harvesting

Tech Fields

Advanced Materials
Medical Devices
Sensors

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If you or your company are interested in this opportunity, Contact:

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