Fabrication and Characterization of Flexible Polymer Iron Oxide Composite Substrate for the Imaging Antennas of Wearable Head Imaging Systems

ABSTRACT

Given the increased interest in wearable electromagnetic imaging systems, developing a low cost, lightweight, flexible, and conformal customised substrate to accommodate the imaging antenna array is essential. The characterization and assessment of a custom-made composite substrate using a flexible polymer poly-di-methyl-siloxane (PDMS) and magnetite iron oxide (FeO.Fe2O3) for wearable head imaging systems is presented. Micro-scale FeO.Fe2O3 particles are homogeneously combined with PDMS in different ratios to build the flexible engineered magnetodielectric (MD) composite substrate. Besides the low cost, fabrication simplicity, and durability, the magnetite FeO.Fe2O3 particles can be used to control the relative permittivity and permeability over a wide range of values to suit the proposed application. The permittivity, permeability and losses of the developed substrate are extracted using a custom-made 2-port multilayer microstrip transmission line test fixture with the help of conformal mapping algorithms. The characterization is performed across the microwave frequency range 1.2 GHz - 4 GHz, which is widely adopted for head imaging. The extracted permittivity is successfully verified by using a Keysight 85070E dielectric slim probe kit.

EXISTING SYSTEM

- In existing system, an efficient and portable EM head imaging system, a wideband, low cost, low profile, flexible, unidirectional, and efficient antenna is required.
- The attainment of an antenna with such features is difficult due to the antenna size restraint as it needs to operate at the low microwave band, high mutual coupling between adjacent antennas and complexity of human head tissues that suppress the penetration of EM waves inside the head.

PROPOSED SYSTEM

- In this paper, a custom-made flexible magneto-dielectric composite substrate based on low-cost iron oxide (FeO.Fe2O3) and polymer polydi- methyl-siloxane (PDMS) technology is proposed for EM head imaging systems.
- Besides the flexibility, durability and lightweight features, the composite substrate has tunable permittivity, permeability, and losses by controlling the composition ratio of the materials.
- This is a notable advantage over conventional printed circuit boards, which have certain dielectric, but non-magnetic, properties.

SYSTEM REQUIREMENTS

HARDWARE REQUIREMENTS:

- Processor - intel core i3
- RAM - 2GB
- Hard Disk - 20 GB

SOFTWARE REQUIREMENTS:

- Ansoft HFSS(High Frequency Structure Stimulator)

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