Optically Transparent Gallium-doped Zinc Oxide (GZO) Antennas for Long-Term Implantation

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Transparent conducting oxides are used in a wide range of applications, especially in the fields of semiconductors, light emitting diodes, and flexible circuitry. Recently Zinc Oxide films are receiving attention due to their low cost, non-toxicity, and stability (thermal and chemical). While non doped Zinc Oxides produce a stable film with high resistivity, Gallium-doped Zinc Oxide (GZO) produces a low resistive and stable film. Gallium doped Zinc Oxide also makes the resulting film resistant to oxidation, (as opposed to Aluminum doped Zinc Oxide). Applications in the past using Gallium-doped Zinc Oxide material has focused on creating transistors and other semiconductor devices. One application that has not been explored in depth is using Gallium-doped Zinc Oxide to design fabricate optically transparent antennas. Transparent antennas has a wide range of applications and uses; military applications include programs where radiating elements have sight sensitivity security requirements. Civilian applications include embedded antennas into windows of buildings, automobiles, and eyeglasses.

In this study, we focus on the medical applications of GZO antennas. ZnO's excellent biocompatibility makes such antennas great candidate for implants. As opposed to conventional copper/duroid based antennas, ZnO-based antennas can stay functional in the body for an extended period of time. To show the performance of the GZO antennas, we have designed and fabricated two different patch antennas. The antennas are simulated and measured using tissue mimicking gels. The gels mimics the dielectric properties of human skin, fat, and muscle. Simulation and measurement data regarding return loss and radiation pattern will be presented.