Transparent Antennas Designed from Hybrid Silver Nanowire with Carbon Nanotube on Flexible Polycarbonate

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Transparent antennas have been widely studied in recent years due to interests in applications such as window glass, display screens, contact lens, and solar cells. Optical transparencies of those antennas could be achieved from transparent conductors or meshed conductors. Although there has been reported success in transparent conductor technology, the tradeoff between the optical transparency and antenna's properties has been a challenge. For the meshed conductor, although it promises an effective antenna with high transparency, the mesh geometry is visible and is not appropriate for application where one needs to hide the antenna.

This paper reports our latest progress in examining antennas fabricated from a hybrid film, where the transparent conductor is a hybrid of silver nanowire and carbon nanotubes. Such a conductive film provides higher endurance against moisture and temperature and provides low skin-depth at frequencies above 3 GHz. The skin-depth dilemma has been a limiting factor for transparent conductor from neat silver wires alone to be effective at lower GHz range, and the hybrid has shown promises to overcome this hurdle.

The paper examines patch antennas deposited on a flexible polycarbonate substrate. Both patch and the ground plane are from the transparent hybrid film. To compare the performance of the hybrid conductor, antennas of the same geometry as the hybrid ones were fabricated by depositing silver metal on the same substrate. Antennas under study were designed for different frequencies and deposited to have varied transparency. Both antenna's radiation properties and transparency are examined, and optimized antenna geometry is proposed. The effect of protective films or sprays on the antenna and ground plane is also assessed.