A stretchable wireless-powered resonator on soft contact lens

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Abstract:

Smart contact lenses—contact lenses with built-in electronics—are a next-generation wearable product with capabilities beyond simple vision correction. Since the electrical lenses are in continuous contact with the eyeball surface, they have three main applications: (i) biomedical sensing of tears to monitor health conditions, (ii) wearable displays for augmented reality (AR), and (iii) actively regulating eye accommodation to ensure perfect vision. Thus, a smart contact lens has substantially greater functionality than an electrical eyeglass.

Recently, we developed two LC resonators that are an in-parallel connection with a loop antenna inductor (L) and a miniaturized ceramic capacitor (C) for an eyeglass and a contact lens [1]. This is designed for power transfer at a resonant frequency of 13.56 MHz. The resonator was mounted on moist, soft contact lens with our original electrochemical (EC) bonding technique, resulting in strong adhesion of the circuit to the lens without losing high power transfer efficiency (50%) from an eyeglass transmitter to the printed receiver lens. However, the gold-loop antenna printed on soft contact lens can peeled off during the drying due to shrinking of contact lens substrate. To overcome this problem, we designed and fabricated a microstructured wave gold antenna by the combination of a photolithography and an electroplating. In the presentation, we will discuss the details about fabrication process, antenna properties, and wireless powered transfer efficiency during 100% stretching.

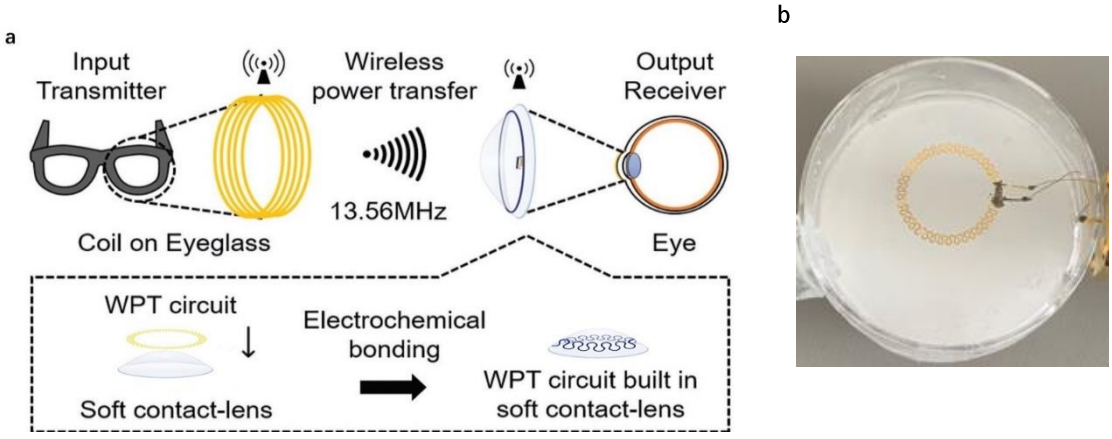

Figure 1. Wireless power transfer (WPT) system from the transmitter on the eyeglass to the receiver on the contact lens. a) The wave gold antenna is mounted on a moist, soft contact lens, via the electrochemical bonding method, and wirelessly receives power from the transmitter at a resonant frequency of 13.56 MHz. b) The microstructured wave gold antenna.

REFERENCES

[1] T. Taiki, et.al, *Advanced Materials Technologies*, 4, 1800671 (2019).