Researcher discusses development of multilayer thin-film antennas

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Dr Yongjin Kim of Inha Technical College, Korea, talks about the work behind the paper 'Design of transparent multilayer film antenna for wireless communication.' Such multilayer thin film antennas are transparent, a quality desirable to designers of mobile technologies, televisions, and other products for which inconspicuous antennas are desirable.

How did you come to work in this field?

I received my B.S. degree in electrical engineering from Inha University in Inchon, and my M.S. and Ph.D. from Ohio State University, Columbus. During graduate school, in the ElectroScience Laboratory at Ohio, I joined several projects involving design of conformal antennas, subsurface target detection/identification, ground bound reduction for outdoor range measurement and radar systems. Then, from 2003 to 2007, I was a senior engineer in the communication and networking laboratory at the Samsung Advanced Institute of Technology in Korea, where I conducted research into the design of various antennas for communication devices, including cellular phones and UWB and RFID antennas. Since then, I have been an associate professor at Inha Technical College. My principle area of research is the design of modern communication antennas and my current interests include a smart antenna system and the development of conductive file antennas with composite materials and structures.

What particular applications are of interest to you?

A variety of studies using transparent electrodes and transparent conductive films have been conducted in RF applications. If the RF performance of a transparent antenna can be made similar to that of a conventional antenna, a wide range of applications in wireless communication become possible, including for the Internet of things (IoT) and RFID. I was interested in the study of this idea and I thought it could lead to a breakthrough in the antenna field.

What have you reported in your Letter?

In the paper, we propose a multilayer thin film antenna for mobile devices. The proposed antenna consists of an IZTO/Ag/IZTO multilayer film that is fabricated on polyimide substrate and a copper layer. The center frequency of the antenna is 1260 MHz. The proposed antenna using an IZTO (indium zinc tin oxide) electrode has an excellent resistive characteristic and high flexibility. Also, it shows a transmittance of 86%. The proposed antenna is made by inserting a thin Ag layer between two layers of IZTO. We placed the IZTO/Ag/IZTO 3-layer structure over a polyamide substrate. The antenna is designed as an IFA type structure with a coupled loop and two branches.

Our antenna has very high transparency and good radiation efficiency, showing an excellent balance with regard to the trade-off between the two. It is also the first antenna model for a mobile hand set using an IZTO/Ag/IZTO 3-layer structure. I think this will be a good basis of research for the future development of the transparent antenna. Of course, the strength of transparent antennas is transparency, they can be attached to many kinds of objects requiring antennas, including TVs, cellular phone displays, automobile glass, etc; and for RFID and IoT applications, where making the antenna inconspicuous may be desirable

for a range of different reasons.

How do you see this field developing and what are the challenges?

The interest for transparent wireless communication devices is increasing due to the demands from a variety of designs and developments in communication services, both from the perspective of visual design and being able to integrate device components more efficiently. Thus, I think the research into transparent electronic components and materials will continue. There are several challenges in this research. One of them is the fine manufacturing process, which is a key point of determining antenna performance. The next one is increasing the conductivity of the 3-layer structure without decreasing the transparency of the antenna. There is also a simulation modelling issue for designing the antenna structure.

What else is your research group working on now?

In the transparent and flexible antenna area, one of my related projects is in the use of composite materials of carbon nanotube and other polymer materials such as a poly-vinylidence fluoridle for antenna applications.

More information: "Design of transparent multilayer film antenna for wireless communication" *Electronics Letters*, Volume 51, Issue 1, 08 January 2015, p. 12 – 14 DOI: 10.1049/el.2014.3831