

Interdigitated Antennas for Broadband Terahertz Generation

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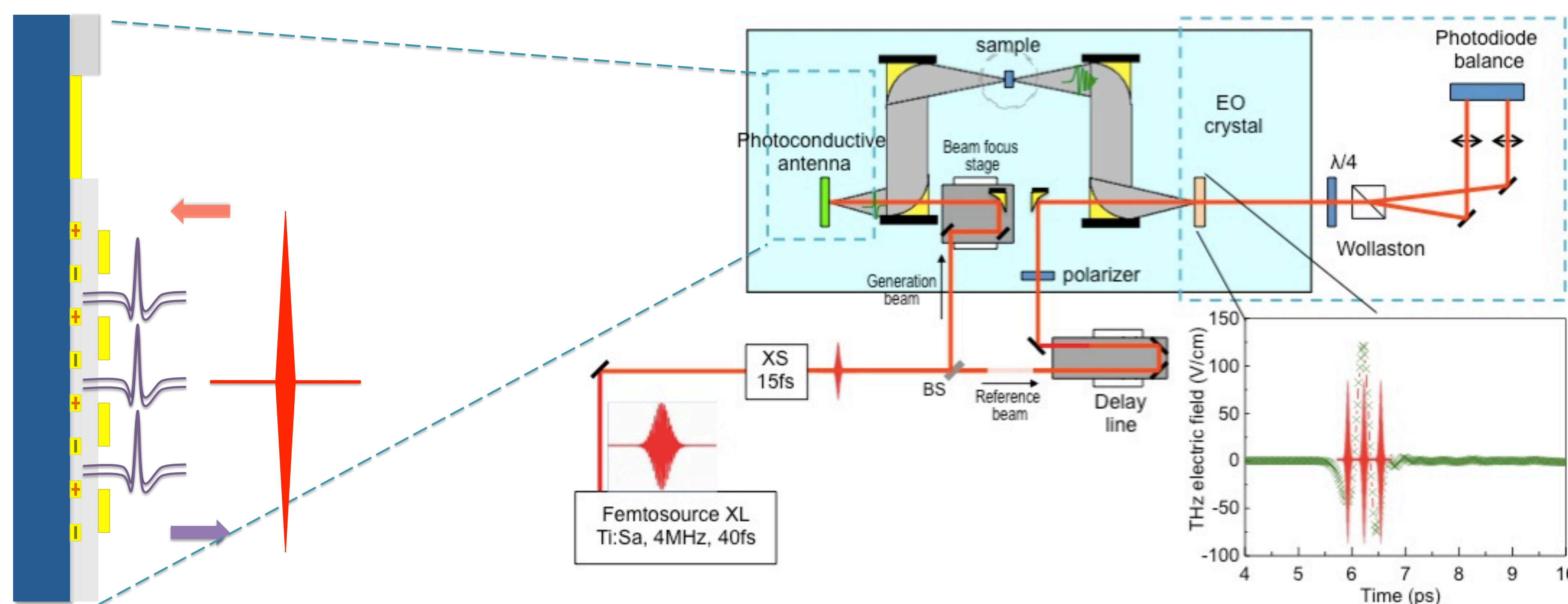
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Interdigitated antennas have become vastly important in the field of Terahertz Spectroscopy because these small area devices have the capability of emitting large quantities of Terahertz radiation. These devices have already been created before, but very few have been fabricated with the maskless alignment photolithography system. With this instrument, we have been able to fabricate large amounts of working antennas in a very short period of time.

Why Terahertz?

Terahertz (THz) Radiation is a form of light found between the microwave and the infrared region. It has spectroscopic properties valuable in telecommunications, medical imaging, and material sciences. Until recently, this region has been inaccessible because THz are very hard to both produce and detect because it lies between the electrical and optical ranges.

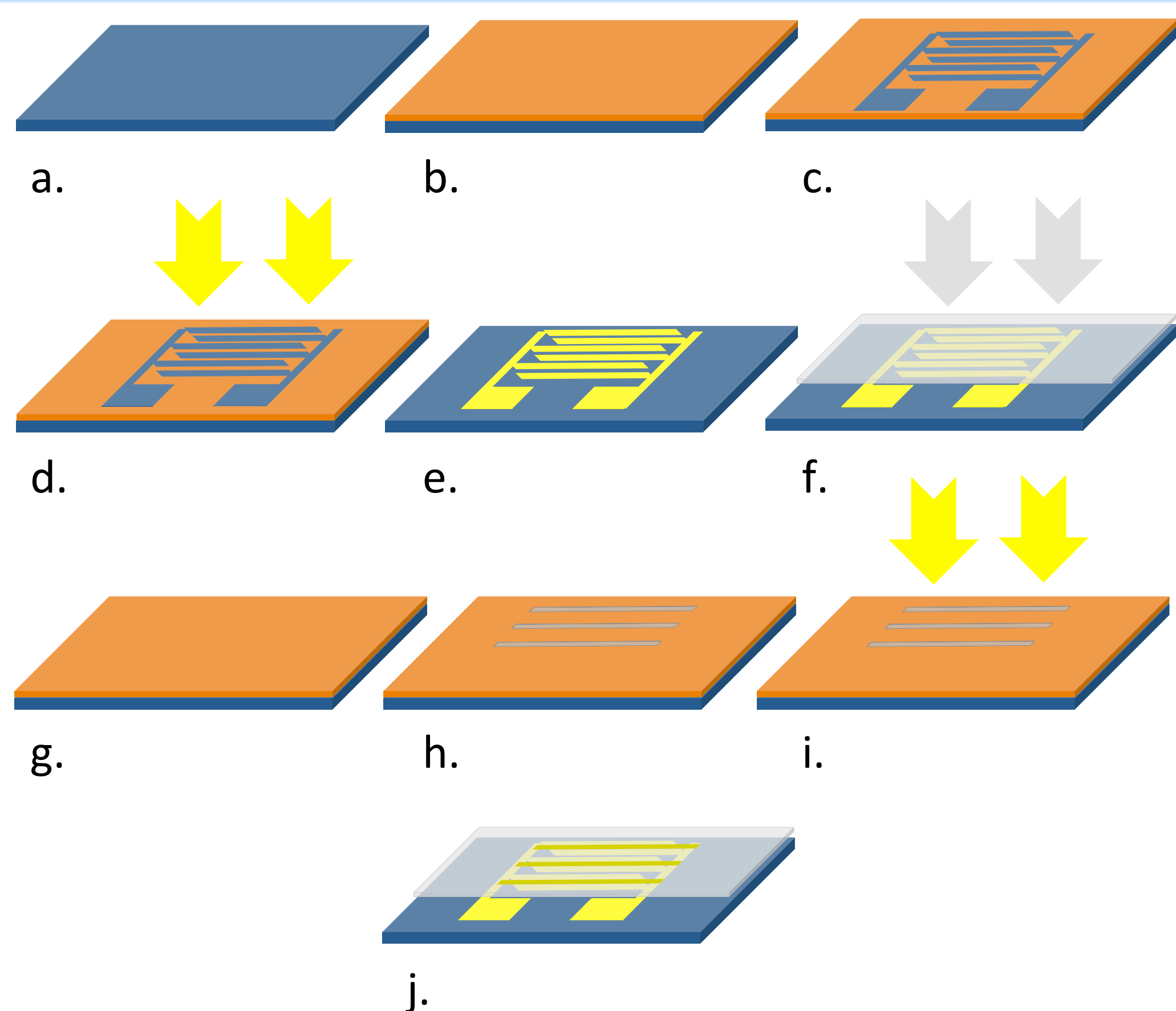
What Is an Interdigitated Antenna?



•An Interdigitated antenna is a device used to give access to the Terahertz range. It is an electrode setup that creates an series of dipoles on a photoconductive substrate.

•When the substrate electrons are excited by a femtosecond laser pulse, they move towards the antenna electrodes because of the dipoles electric field. This acceleration of charges generates and emits a pulse of the a tunable Terahertz frequency.

Fabrication Procedure

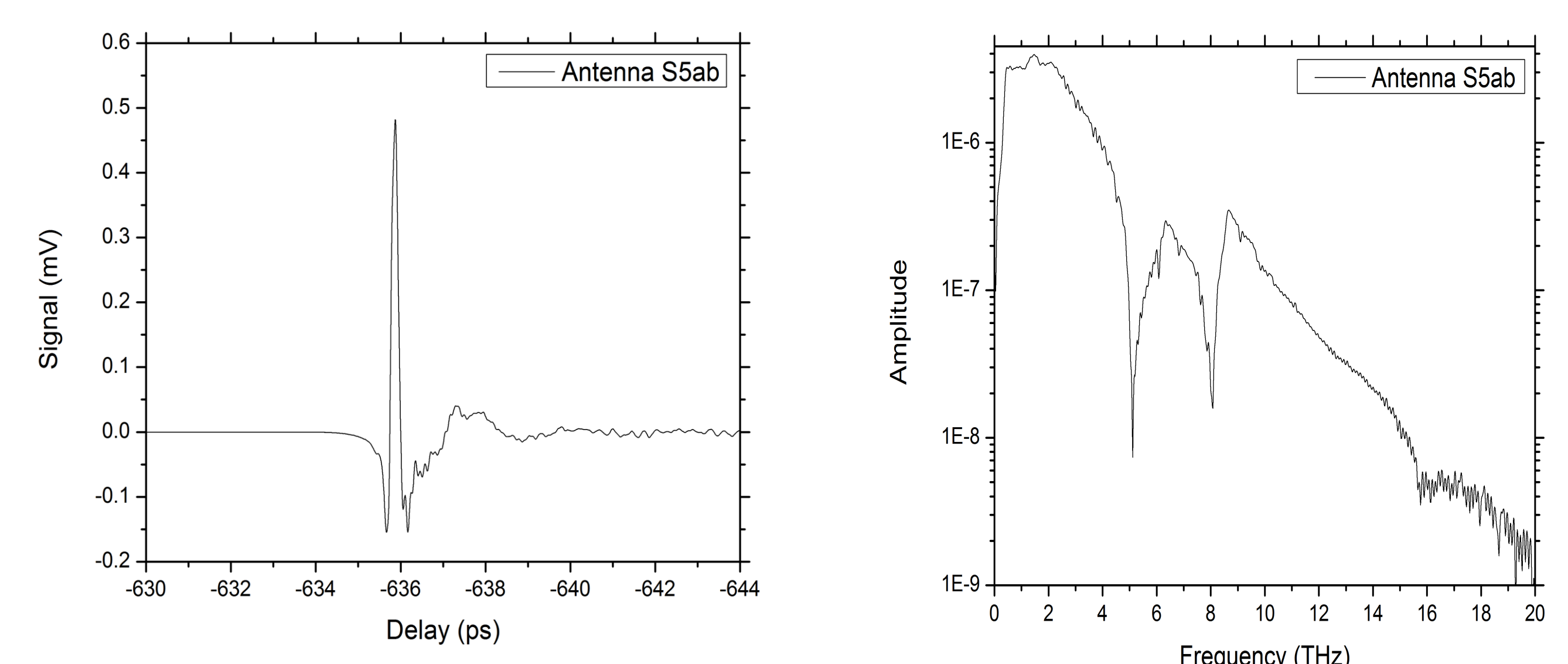


- The GaAs Substrate is cut and cleaned
- Shipley's S1813 photoresist is spun on to a 1 μm thickness
- The sample is exposed to UV radiation in Maskless Alignment System and developed with TMAH
- TiO_2 and Au is Evaporated on sample
- Lift-off to remove the unwanted photoresist and gold
- Cover the bonding pads and sputter a buffer layer of appx. 500nm of SiO_2
- Photoresist is spun on again
- Exposure and development
- Evaporation of Au Top layer
- Lift-off, final device

Results

•We created an array of 240 antennas. We performed preliminary resistance measurements on 16 antennas: 9 were workable devices.

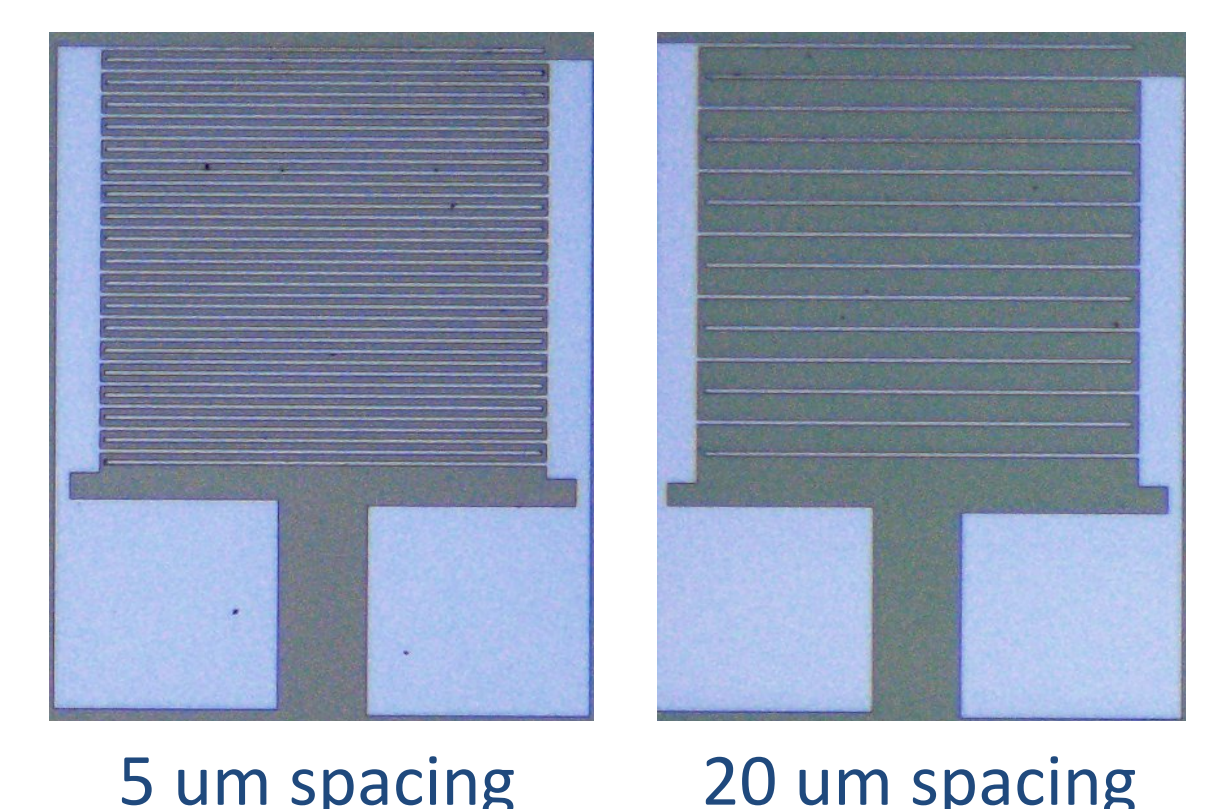
•We tested one of those with the THz TDS system:



•Measured signal intensity of 0.5 mV and bandwidth of >15 THz

Future Research

•We have the freedom to manipulate the parameters, so we can easily change the antenna design and see exactly how the properties correlate to the individual parameters affected.

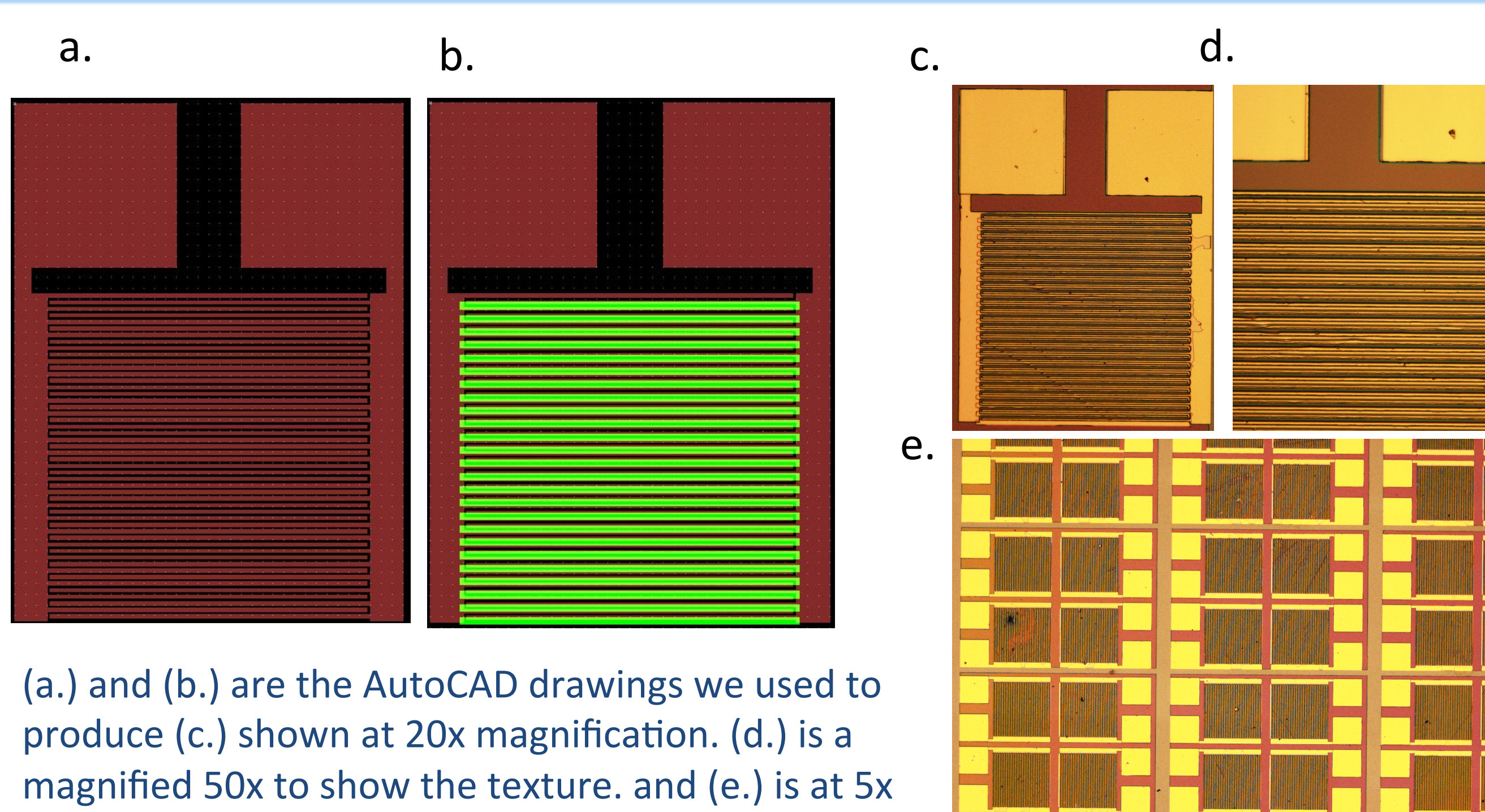


•Because of the rate at which we can produce these devices, we can use these devices as tools for collaboration. A quote for a single device was \$2500, and we made 240 in one batch. The desire and demand will make our product or method very attractive to others in the field.

Acknowledgements

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AutoCAD and the Array: The Two Key Factors



(a.) and (b.) are the AutoCAD drawings we used to produce (c.) shown at 20x magnification. (d.) is a magnified 50x to show the texture. and (e.) is at 5x magnification to show the array of antennas.