Supporting Information

Cell viability and hydration assay based on metamaterial-enhanced terahertz spectroscopy

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Content

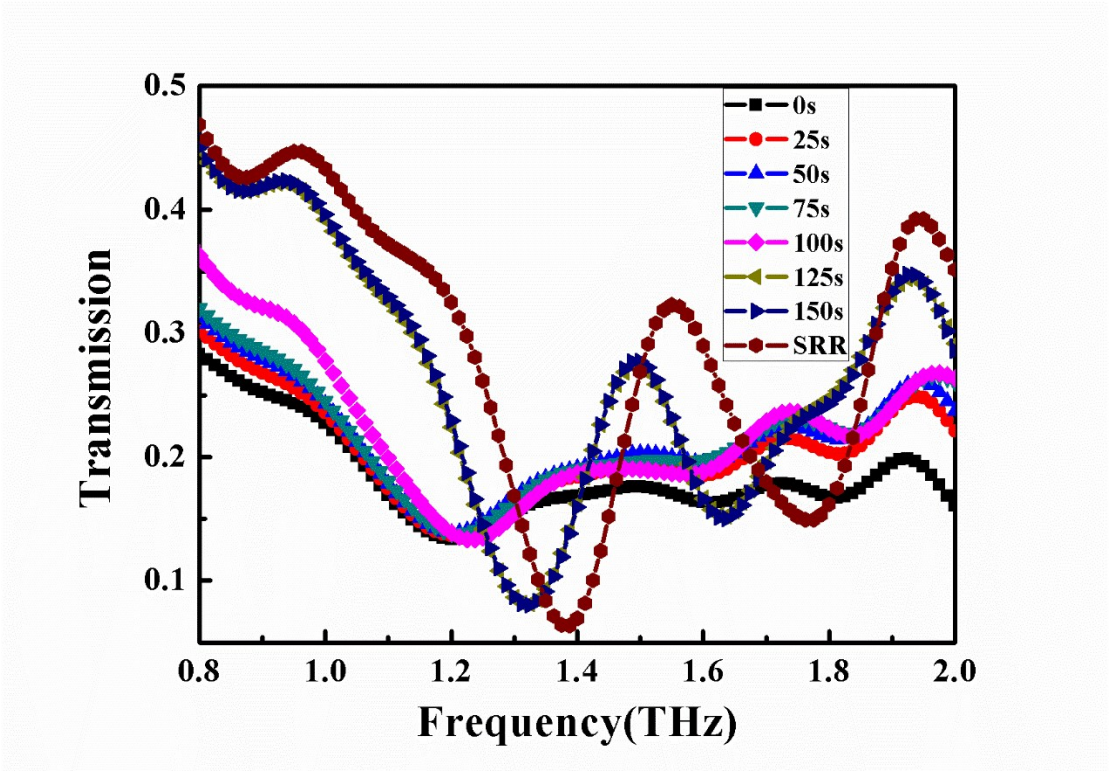

Figure S-1. THz transmission spectra measured with U87 cell monolayer within 150sec in a relative humidity of 3%.

In order to verify the repeatability, the parallel experiment had been carried out with the other one metamaterial of the same structure. Although the two inherent resonance frequencies of the blank SRR (1.387THz and 1.762THz), are different from these mentioned in the article (1.375THz and 1.737THz), the changes are acceptable and regularly which both undergo a further blue-shift. Thus, it can be demonstrated the system with good repetition.

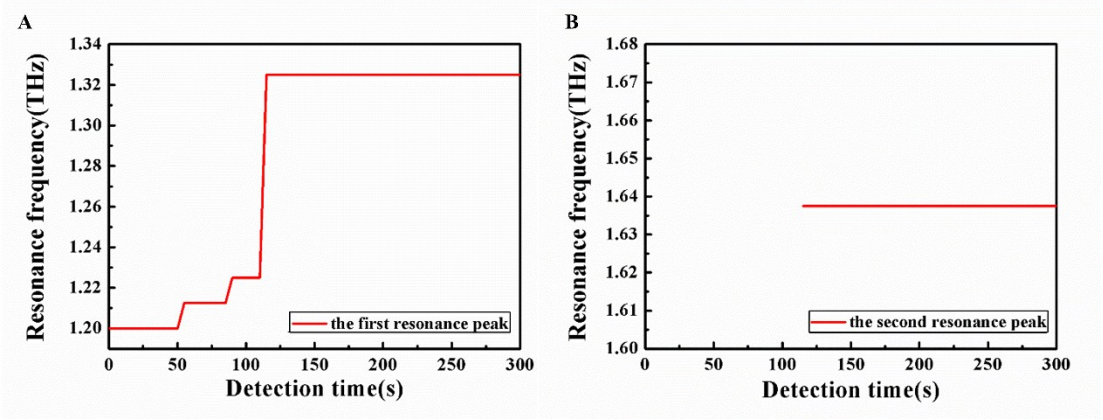

Figure S-2. The changes of the resonance frequency within 300sec in a relative humidity of 3%. (A). The changes of the first resonance peak within 300sec. (B). The changes of the second resonance peak within 300sec.

The change of the first resonance peak divided into four phases with its time evolution. The resonance frequency of the first phase was 1.2THz, continuing for about 50sec. At 55sec, the resonance frequency shifted to 1.212THz, and continued until 85sec. After another 5sec, the resonance frequency reached 1.225THz, and lasted for 20sec; ultimately, the resonance frequency stabilized around 1.325THz and did not change again with time. What's more, the change of the second resonance peak are nearly identical to the law mentioned in the article. The resonance peaks are indistinctive until 115sec, and thereafter the resonance frequency remained at 1.637THz.

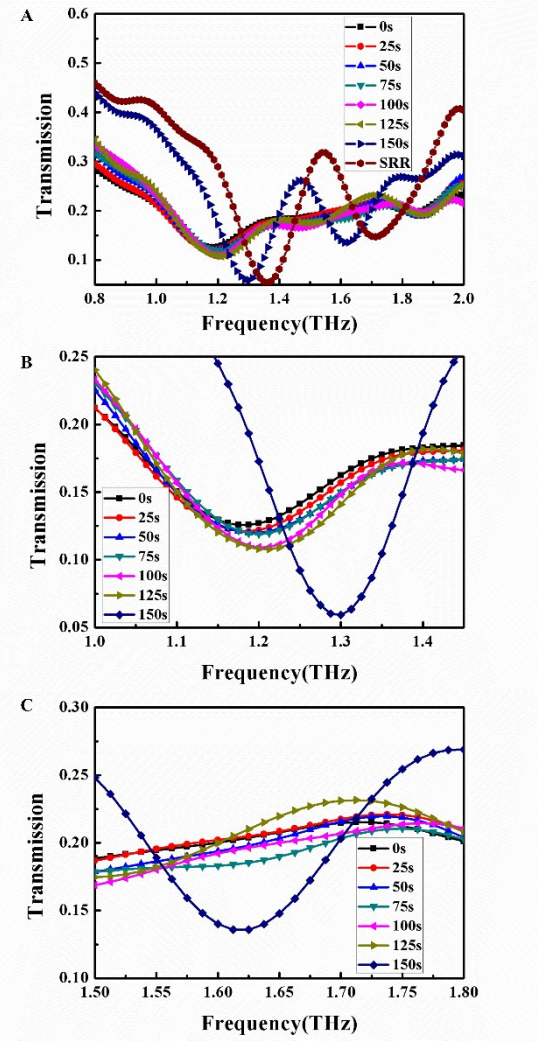

Figure S-3. THz transmission spectra measured with U87 cell monolayer within 150sec in a relative humidity of 7%. (A). THz transmission spectra measured with U87 cell monolayer within 150sec. (B). THz transmission spectra of the first resonance peak measured with U87 cell monolayer within 150sec. (C). THz transmission spectra of the second resonance peak measured with U87 cell monolayer within 150sec.

In order to better explain the experiment results, the U87 cell monolayer was detected under the same experimental conditions, except the relative humidity. Under a relative humidity of 7% and with a measurement time of 5 sec, a series of resonance frequencies has been observed (A), and in order to clearly show the results, the better-visualized results of the first (B) and the second (C) resonance peaks were showed respectively.

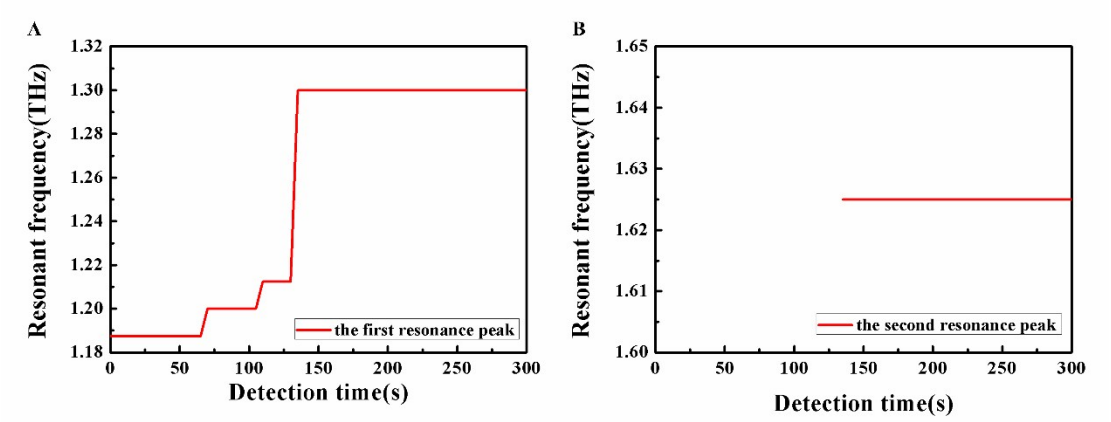

Figure S-4. The changes of the resonance frequency within 300sec in a relative humidity of 7%. (A). The changes of the first resonance peak within 300sec. (B). The changes of the second resonance peak within 300sec.

The change of the first resonance peak divided into four phases with its time evolution. The resonance frequency of the first phase was at 1.187 THz, continuing for about 65 sec. At 70 sec, the resonance frequency shifted to 1.2 THz, and continued until 105 sec. After another 5 sec, the resonance frequency reached 1.212 THz, which briefly lasted for 20 sec; ultimately, the resonance frequency stabilized around 1.300 THz and did not show any noticeable change again with time. What's more, for the second resonance peak, the resonance peaks are indistinctive until 135sec, and thereafter the resonance frequency remained at 1.625THz.

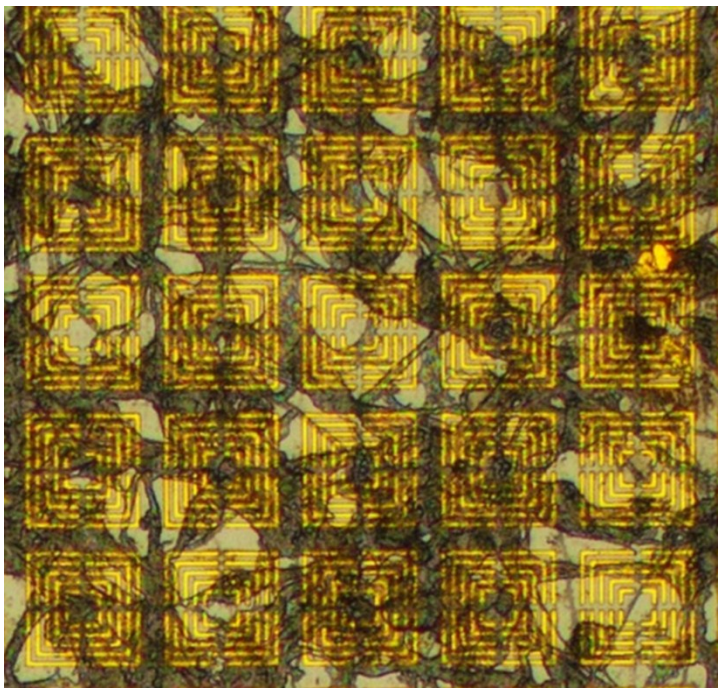

Figure S-5. An optical microscope image of THz metamaterial covered with dry U87 cell monolayer at the end of experiment.

In order to observe the morphological changes of U87 cell monolayer covering in the THz metamaterial, the optical microscope was used. The result indicated that due to water loss, the morphology of cells have been destroyed and changed seriously.