Nanowire Based Split Ring Resonator

Technology No. 20160144

IP Status: Issued US Patent; **Application #:** 15/482,409

Split Ring Resonator Using Displacement Current

A nanowire based single ring resonator (SRR) bio microsensor significantly enhances quality factor (Q-factor) and sensitivity. The proposed nanowire-based SRR employs a displacement current that flows through nano dielectric gaps between metallic nanowires of the SRR, resulting in minimized dissipative heating and eddy current generation as well as maximized energy storage. Small gaps in the SRR act as multiple sites for chemical or biomolecule detection, and the new technology does not require tagging molecules to detect them. In addition, the SRR emits low ionizing energy (less harmful than x-rays) and does not require E-beam lithography.

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Enhanced Q-factor, sensitivity and tunability

Single ring resonators (SRRs) are artificially produced metamaterial structures with properties of electromagnetic wave manipulation not found in nature. However, conventional thin film SRRs have a low quality factor (Q-factor), low sensitivity and low frequency shift, which limit their function as sensors. Current methods to enhance the Q-factor still don't meet the needs of ultra-sensitive biosensors. The proposed nanowire-based SRR demonstrates broad range tunability, roughly a 20-fold increase in sensitivity and about a 30-fold Q-factor increase.

BENEFITS AND FEATURES:

- Enhanced sensitivity/resolution (frequency shift 20x better than thin film SRRs)
- Increased Q-factor expected: 30x better than conventional thin film SRRs
- Low ionizing energy is less harmful than x-ray for imaging applications
- Small gaps in SRR act as multiple sites for chemical or biomolecule detection
- Does not require tagging molecules or electron-beam lithography

APPLICATIONS:

- Nanobiosensors
- Low ionizing radiation imaging
- Portable, "lab on a chip" sensors to detect specific chemicals
- Biological and biomedical sensing

Phase of Development - Prototype Development. Early stage. Nanopillar (nanowire) based SRRs have been characterized, fabricated, and tested and correspond well between simulations and experimental data.

Researchers

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Publications

Displacement Current Mediated Resonances in Terahertz Metamaterials
Advanced Optical Materials, Volume 4, Issue 8, August 2016, Pages 1302–1309

External Links

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