

Acoustic Enhancement of Photodetecting Devices

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Technology Summary

ORNL inventors developed a method that enhances the photodetecting ability of devices used in many applications, from television remotes, to standoff detectors for suspect materials, to advanced weapons guidance. Using a high Q acoustic resonator, the invention increases the sensitivity of the detectors by an order of magnitude—producing a dramatic improvement in detection levels. The invention provides a very economic way of enhancing the sensitivity of detectors that would otherwise be too unresponsive to use.

The ability to sense light plays a crucial role in many modern applications. The sensitivity of photodetecting devices is established while they are produced, with little means to improve sensitivity afterwards. Techniques have been developed that use electronic instrumentation to lower the output noise, but unfortunately, such filters and instrumentation also reduce the ability of a device to detect very low signals.

In this invention, a photodetecting device receives a light pulse having a pulse rate. The pulse generates an electronic signal that is dampened by an electromechanical acoustic resonator, such as a quartz crystal tuning fork or a piezoelectric actuator. Dampening the electronic signal increases the signal-to-noise ratio. The result is increased photodetector standoff distances and sensitivities.

Advantages

- Increases photosensitivity by an order of magnitude by coupling the detector device output to a high Q acoustic resonator
- Provides a very economical solution to enhancing commercially available detectors
- Can be used to enhance sensors of already high sensitivity to gain extra detection distance

Potential Applications

- Photoresistors, photovoltaics, and photodiodes
- Advanced weapon guidance systems
- Television and electronics remote controls
- Standoff detection of residues using spectroscopic techniques requiring photodetectors of high sensitivity

Patent

Charles W. Van Neste, Larry Senesac, and Thomas Thundat, *Acoustic Enhancement for Photo Detecting Devices*, U.S. Patent Application 12/837,703, filed July 16, 2010.

Inventor Point of Contact

Charles W. Van Neste
Measurement Science and Systems
Engineering Division
Oak Ridge National Laboratory

Licensing Contact

Renae Speck
Senior Technology Commercialization Manager,
Biological and Environmental Sciences
UT-Battelle, LLC
Oak Ridge National Laboratory
Office Phone: 865.576.4680
E-mail: speckrr@ornl.gov

