

Night vision devices using pyroelectric sensor with metamaterial based heat control

Unmet Need

Night vision and thermal imaging are key technologies used by the military, security and rescue services around the world in combat operations, intelligence, surveillance and guidance systems. They are also widely employed in the industry enabling detection of hot spots in electrical or mechanical installations, and in building diagnosis to conduct energy audits, detect moisture in ceilings, walls, or roofs, and plumbing leaks or blockages. However, vacuum tube technology that night vision devices have been relying on for almost a century restricts the size and durability of devices. Using pyroelectric crystals as a sensing element in infrared radiation detectors has been shown to be an advantageous alternative. A pyroelectric crystal polarization changes with temperature generating an electrical signal that can be converted into an image. However, a major drawback of pyroelectric detectors is that as a crystal receives the signal it heats up, and continuous sensing leads to overheating and quick saturation. The use of a heat sink does not solve the issue as heat buildup is essential to the measurement process. Mechanical choppers traditionally used to circumvent the issue are not practical as they add bulk and moving parts to the devices. Therefore, there is a need for a novel design that would draw heat away from the sensor while keeping the device efficient, responsive, small and lightweight.

Technology

A Duke University researcher has developed a novel solid-state heat throttle design that efficiently cools the pyroelectric sensor by allowing the controlled draw of heat out of the crystal. The new device utilizing this



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Meet the Inventors

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External Link(s)

- [From the lab of Dr. Krishnendu Chakrabarty](#)

heat throttled meta-pyroelectric design will have the advantage of better sensitivity over traditional technology while being small, light, durable and cheap.

Advantages

- Allows night vision devices to be as thin as prescription glasses
- More durable and efficient than current technology
- Low cost

