

SIRKELI, V., YILMAZOGLU, O. et al. Proposal for a monolithic broadband terahertz quantum cascade laser array tailored to detection of explosive materials. In: Sensor Letters. 2018, Vo.16, Nr.1, pp. 1-7. ISSN 1546-198X.

Since most tunable THz sources produce only small power levels, we propose for routine evaluation of dangerous materials to employ a chain of quantum cascade THz generators, where each of them addresses a specific spectroscopic line of the relevant identifying spectrum. Therefore, we present the design, operating principle and performance of a room-temperature monolithic broadband terahertz (THz) source for applications of THz imaging and detection of explosive materials such as TNT, RDX, PETN and HMX. The suggested terahertz source is a 20-element array of quantum cascade lasers (QCLs) emitting at discrete frequencies from 0.85 to 4.74 THz. The layer structure of each individual THz QCL is based on a two-well design scheme with variable barrier heights and resonant-phonon depopulation of the lower laser state. The tailoring of emission frequency of individual THz QCLs in the laser array was made by varying the constituent epilayers' width and doping level of the injector well. We found that the peak optical gain of the discrete THz QCLs is increased with increasing tailored THz emission frequency. The detection of the transmitted line can be done by THz Schottky diodes after relevant narrow-band filters. The other detector concept could be quantum cascading, where its narrow-band filter property allows the detection of the relevant THz line. This system is intended for routine security testing, where speed and reliability are required.