

6<sup>th</sup> International Conference and Exhibition on

# Materials Science and Engineering

September 12-14, 2016 Atlanta, USA

## Terahertz laser sources based on difference frequency generation of infrared nonlinear optical materials $\text{SnGa}_4\text{Q}_7$ (Q = S, Se)

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Terahertz (THz) wave is the explosion of applications requirements, especially in the fields of security and biomedicine. However, there are still delays in a widespread use of THz technology due to the scarcity of reliable, simple use sources produced on a large scale. New mid/far infrared nonlinear optical crystals  $\text{SnGa}_4\text{Q}_7$  (Q = S, Se) can be used to design laser sources of THz wave by difference frequency generation (DFG) process. In order to simulate the output THz light, we have calculated the conversion efficiencies of THz source, which are relative with the cutoff edge of transparent infrared spectrum, absorption coefficient of THz light, and figure of merit, based on the DFG process of infrared nonlinear optical materials  $\text{SnGa}_4\text{Q}_7$  (Q = S, Se). The calculated phonon dispersions and phonon band densities are employed to determine the transparent cutoff edge of infrared spectrum. The calculated infrared intensities are used to derive the absorption coefficients of THz wave. The calculated nonlinear optical parameters and linear refractive indices are used to determine the figure of merit. The obtained results show that the THz conversion efficient of  $\text{SnGa}_4\text{Se}_7$  is much larger than that of  $\text{SnGa}_4\text{S}_7$  under the same experimental conditions, and the THz absorption significantly reduce the conversion efficiency of THz source for the materials of  $\text{SnGa}_4\text{Q}_7$  (Q = S, Se). We should choose more wide transparent material in mid/far infrared zone or avoid the THz absorption band of material, and choose a large figure of merit material in designing THz source based on DFG process.

### Biography

Wen-Dan Cheng has a tenured position at Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences. He received his MS degree from Xiamen University in 1981. He worked as a visiting Professor from 08/1998 to 02/1999 at the Department of Physics, Michigan Technological University, as a Visiting Scholar from 08/1992 to 12/1993 at the Department of Chemistry, Arizona State University and from 08/1987 to 07/1988 at the Department of Chemistry, University of Calgary. He has published about 200 papers in reputed journals and has been serving as a referee for leading research journals and as an organizer of International Workshop of Computational Materials Science at Fuzhou PRC in 2009.

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