

Germanium-Silicon Alloys – New Materials for Microbolometers

Prof. Dr. Mukti M Rana

Professor of Engineering, Division of Physical and Computational Sciences
Director and Principal Investigator, Optical Science Center for Applied Research
Delaware State University, Dover, DE 19901, USA

Abstract:

Microbolometer is a class of IR detector whose resistance changes because of change in temperature. Choice of sensing layer plays an important role for microbolometer's performance. They are used in contact-less temperature measurement, night vision cameras for defense, security and surveillance applications, search and rescue and many other thermal imaging applications. For these types of detectors, wavelengths of interest are mainly in the atmospheric windows - ranging from 3 to 5 (MWIR) and 8 to 14 (LWIR) μm wavelength ranges, due to the high transmission through atmospheric air of more than 80% and peak IR emission of room temperature bodies is at 9-10 μm of wavelengths.

The materials to be used for sensing layers of microbolometer must be capable of absorbing the infrared radiation, pose high temperature coefficient of resistance (TCR) and moderate resistivity as well as low noise. Germanium-Silicon alloys exhibit high temperature coefficient of resistance and higher $1/f$ -noise as compared to their counterparts. In this talk, I will provide the in-depth discussions of these materials while they are used in microbolometers.

About the Speaker:



Prof. Dr. Mukti M Rana is a Professor of Engineering and Director and Principal Investigator at the Optical Science Center for Applied Research (OSCAR) at Delaware State University (DSU). Dr. Rana received his B.Sc. in Electrical and Electronics Engineering from the Khulna

University of Engineering and Technology, Bangladesh (1992-1997), and his M.S. (2000-2002) and Ph.D. (2003-2007) from The University of Texas at Arlington (UTA) in Electrical Engineering. He also worked as graduate teaching assistant, graduate research assistant and post-doctoral research associate (2007-2008) in the Department of Electrical Engineering during his tenure at UTA. In fall 2008, Dr. Rana joined as an Assistant Professor in the Department of Electrical and Computer Engineering at The University of South Alabama, Mobile. In 2010, he joined in the Department of Physics and Engineering and OSCAR of DSU. Dr. Rana is the principal investigator of Optics for Space Technology and Applied Research Center funded by the National Aeronautics and Space Administration (NASA). This grant is funded for 5 Million US dollars for 5 years. Dr. Rana's research projects are also supported by the Department of Defense (US Army, Navy and Air Force) and National Institute of Health. Dr. Rana has secured more than 13 Million US Dollars in research funding during his tenure at DSU. Currently there are six graduate, five undergraduate, one post-doctoral research associate and three high school students work at Dr. Rana's research laboratory -Laboratory for Optical Sensing and Energy Conversion. His current research interest includes - thin film's properties for microsensors' applications, uncooled infrared detectors and microelectro-mechanical (MEMS) devices. Dr. Rana has published more than thirty one refereed journal articles and conference proceedings, one book, one book chapter and holds one patent. Dr. Rana is a member of the IEEE, SPIE and the founding student advisor of IEEE student branch at DSU. Dr. Rana is the recipient of excellence in research award in 2016, vice president's award for excellence in research in 2015 and excellence in outreach award 2015 for the college of mathematics, natural sciences and technology of DSU.