

High Temperature Photoconductivity of 2D Layers of MoS₂

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Abstract: MoS₂ is in Transition Metal dichalcogenides (TMDCs) category which is a widely researched material due to its electronic behavior such as photoconductivity. In this dissertation we mainly focus on high temperature Photoresponse behavior of Metal-Semiconductor-Metal (MSM) MoS₂ photodetectors. Photodetectors are one of the main part of electronic based applications such as telecommunications and opto-electronic industry. Here we designed MSM photodetectors using prepatterned gold electrodes and few layers of MoS₂ flakes which were synthesized using mechanical exfoliation assisted dry transfer method. Then to understand the photoconductive behavior, devices were used for opto-electronic measurements. So here we present the electronic and optoelectronic properties of 2D layers of MoS₂ flakes within the temperature (T) range of ($290\text{ K} < T < 360\text{ K}$). Temperature-dependent photoconductivity measurements performed within this range, using a continuous laser source of $\lambda = 640\text{ nm}$ over a range of effective illuminating laser intensities, P_{eff} ($0.1\text{ }\mu\text{W} < P_{\text{eff}} < 0.8\text{ }\mu\text{W}$) indicates the possibility of achieving high photoresponsivity beyond room temperatures and at ambient conditions. For example, it is found that the achieved peak Responsivity (R) and Detectivity (D) are 8.88 A/W and $6.1 \times 10^{10}\text{ Jones}$ at 0.5 V respectively. Furthermore, the impact of temperature and incident light power on gamma factor (γ) at high temperature range is thoroughly examined. Apart from that effect of the Annealing on photoconductivity was observed and reported.

Biography: Dushmantha Gusthigngnhadurage is a Ph.D. student in Applied Physics at Southern Illinois University Carbondale. He holds two Master's degrees in physics, one from Southern Illinois University Carbondale and another from the University of Strasbourg, France, and a Bachelor's degree from the University of Kelaniya, Sri Lanka. His research focuses on the High Temperature-dependent photoconductivity of 2D materials under the guidance of Prof. Saikat Talapatra. In addition to his research, he serves as a Teaching Assistant in the Department of Physics and as a Graduate Assistant at the Micro Imaging and Analysis Center, where he operates the Scanning Electron Microscope (SEM) for clients.