# Intrinsic properties and environmental effects in time-resolved photocurrent in CVD $MoS_2$ monolayer.

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Abstract

With molybdenum disulfide's ($MoS_2$) interest as a two-dimensional direct band-gap semiconductor for optoelectronic applications, a significant attention was paid to the time dependence of photocurrents in $MoS_2$ based photodetectors[1, 2, 3]. Despite the richness of the discussion on this issue, there is no common approach to describe their temporal responses. Some of the frequently used descriptions do not include any information about physical phenomena occurring within the material. In this work we propose a new versatile model of the photocurrent temporal response of $MoS_2$-monolayer-based devices with a description that distinguishes 3 exponential components. These components correspond to different physical effects found in $MoS_2$ photocurrent response: photoconductivity, photogating with intrinsic material origin and environmental photogating. It is the first time that photogating has been distinguished in such a manner. We also show that consideration of the rising side of the photocurrent results in a more accurate information about persistent photoconductivity in CVD samples than the decaying signal. The versatility of the model is proved applying it to a representative selection of literature data.

References

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[3] Di Bartolomeo, A.; Genovese, L.; Foller, T.; Giubileo, F.; Luongo, G.; Croin, L.; Liang, S. J.; Ang, L. K.; Schleberger, M., Nanotechnology 2017, 28 (21).

Figures

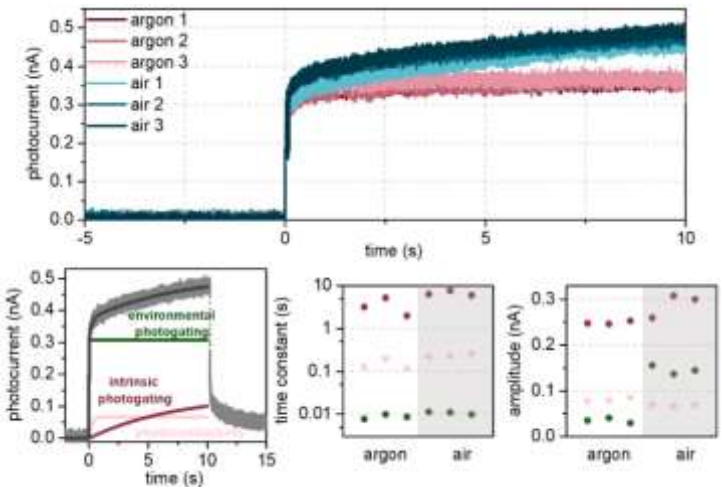


**Figure 1:** Top: time-resolved photocurrent in the rapid atmosphere change from argon to air. Bottom: our model applied to the photocurrent measurement extracting 3 separate components for time constants and amplitudes due to environmental photogating, intrinsic photogating and photoconductivity.