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Unity free carrier generation in 2D perovskites quantum well structures

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Two dimensional perovskites with a quantum well structures have demonstrated superior air stability because of the hydrophilic property functionalized by the organic molecule spacers. Thus, 2D perovskites are promising absorbers for the next generation photovoltaic technology. However, it remains a significant challenge to desirable free carriers because of the strong quantum confinements, leading to the exciton generation upon light absorption.
In this report, we demonstrated that we engineer the nanostructure, perovskite composition, and organic molecule spacers to tune the carrier generation from strong bonded exciton to free carriers. Using the novel ultrafast photocurrent spectroscopy, we have characterized the ultrafast carrier dynamics in less than one nanosecond upon a femtosecond laser excitation. By studying the carrier dynamics under temperature, electrical field, and photon flux, we have achieved 100 % free carrier photogeneration quantum efficiency. We have addressed the most fundamental photogeneration question for the perovskite field and pave the pathway for the perovskite solar cell efficiency improvement.
References:

• Kanishka Kobbekaduwa, et.al. and Jianbo Gao. (2023). Ultrafast Carrier Drift Transport Dynamics in CsPbI3 Perovskite Nanocrystalline Thin Films. ACS Nano.
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Keyword-1

2D Perovskite

Keyword-2

ultrafast

Keyword-3

carrier dynamics

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