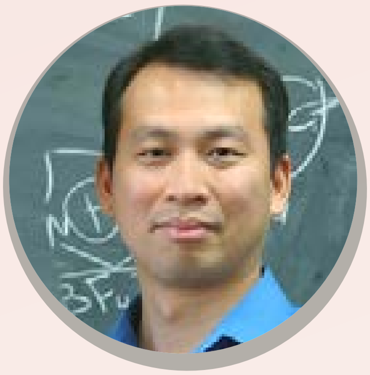
Junrong Zheng, J Biotech and Phyto 2017



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Electron/hole transformation between two atomic layers

Electron/hole transformations on interfaces determine fundamental properties of opto-electro-chemical devices, but remain a grand challenge to experimentally investigate and theoretically describe. Herein combining ultrafast VIS/NIR/MIR frequency-mixed micro-spectroscopy and state-of-the-art two-dimensional atomic device fabrications, we are able to directly monitor the phase transitions of charged quasiparticles in real time on the ultimate interfaces – between two atomic layers. On type II semiconductor/semiconductor interfaces between two transition metal dichalcogenide (TMDC) monolayers, interfacial charge transfers occur within 50fs and interlayer hot excitons (unbound interlayer e/h pairs) are the necessary intermediate of the process for both energy and momentum conservations. On semiconductor/conductor (graphene) interfaces, interlayer charge transfers result in an unexpected transformation of conducting free carriers into insulating interlayer excitons between the conducting graphene and the semiconducting TMDC. The formation of interlayer excitons significantly improves the charge separation efficiency between the two atomic layers for more than twenty times.

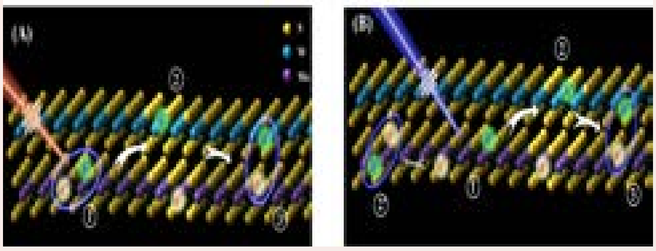

Figure 1. Interlayer charge transfers between MoSe2/WS2 atomic layers. The interlayer charge transfers (<50fs) result in the formation of interlayer hot excitons, much faster than the formation of intralayer excitons (~600fs).

Biography

Junrong Zheng completed his PhD and postdoctoral studies from Stanford University. He is professor of chemistry at Peking University, and a co-founder of Uptek Solutions, a Long-Island-based laser company. He is a recipient of numerous prestigious awards including the Sloan Fellowship, and the Packard Fellowship.

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