Atomic-precision Control of Single-crystalline 2D Materials

& Recent Progress on Thin Film PV in IBM

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The fabrication of large-scale single-domain graphene is one of the most important research goals in the field of graphene research. Recently, we have developed a technique for fabricating an unprecedented form of a flat, single-oriented, monolayer graphene in a 4-inch wafer-scale. This graphene was proven to be cyrstallographically and electrically single-domain in a wafer-scale. The physics behind forming single-crystalline graphene will be discussed.

This single-crystalline graphene was used as a seed for growing single-crystalline films. We, for the first time, demonstrated direct van der Waals growth of high-quality single-crystalline films on this graphene with low defectivity. The single-crystalline film was then released precisely from a graphene surface and transferred onto Si substrates. The graphene/SiC substrate was reused for multiple growth and transfer cycles without any post-release surface treatment. I will talk about the detail of this process and how this accomplishment can be applied to current 2D material research.

I will also present our recent progress on fabricating high efficiency thin film solar cells including $Cu_2ZnSn(S,Se)_4$, amorphous silicon, and organic solar cells.

References

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BIO

Dr. Jeehwan Kim is a Research Staff Member at IBM T.J. Watson Research Center. He received his Ph.D. degree in Materials Science and Engineering from UCLA in 2008. Since he joined IBM TJ Watson Research Center right after graduation, he has led multiple projects including thin film solar cells, graphene electronics, and next generation CMOS. In 2012, he was appointed a “Master Inventor”, a recognition awarded to a few prolific scientists each year. He is a recipient of multiple IBM high value invention achievement awards. Dr. Kim is an inventor of 90 US patents and a first-author of 20 journal papers. His current research interests are in light management in nanostructured thin film solar cells, graphene-based layer-transfer, and single-crystalline 2D-material heterostructures.