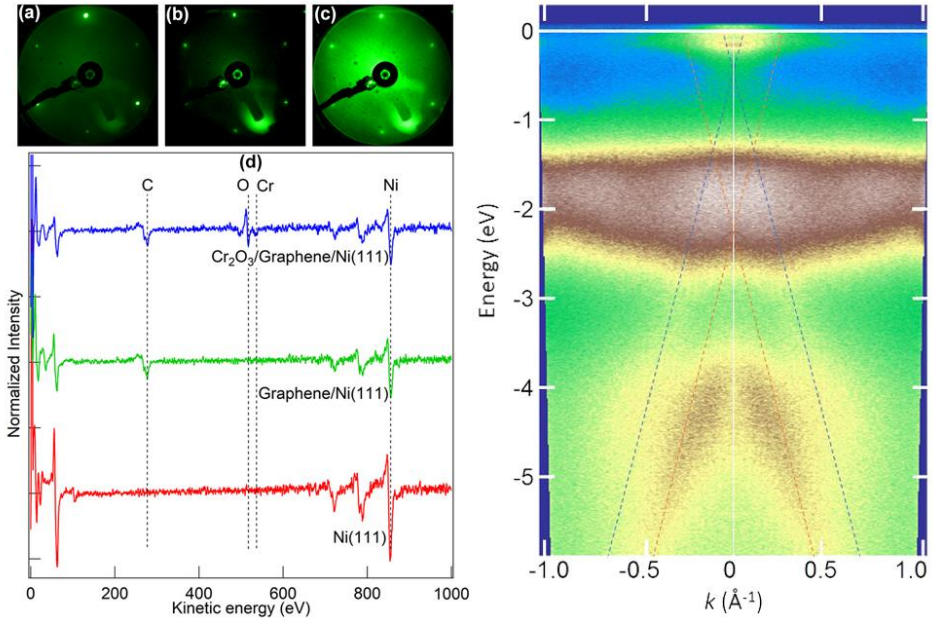
Splitting of Dirac band on Cr_2O_3/Graphene/Ni(111)

Xueyao Hou [1], Masahiro Sawada [2], Shiv Kumar [2], Kenya Shimada [2]
1. Graduate School of Science, Hiroshima University
2. Hiroshima Synchrotron Radiation Center, Hiroshima University

Graphene is one of the most promising Dirac electronic systems. By functionalizing graphene, a sizable local magnetic moments and spin-orbit coupling can be induced in graphene. The main known mechanism responsible for the π band modifications including: the spin-dependent hybridization with the *d* states of the transition metal (proximity exchange), spin splitting due to inversion symmetry breaking (Bychkov-Rashba splitting) and the sublattice-symmetry breaking (pseudospin splitting). Recently, it has been predicted that a nontrivial band gap opening in the graphene Dirac bands asymmetric between K and K valleys at antiferromagnets Cr_2O_3/graphene interface, which is mediated by symmetry protected boundary magnetization of Cr_2O_3 and proximity effect induced SOC. The fabrication of this structure has been realized by Picone's group successfully on Ni(111) substrate. Moreover, a narrowed band gap of ultrathin α-Cr_2O_3 than that of crystal was observed by STS. While this progress is impressive, it is recognized that the size of bulk material often largely exceeds the characteristic for inducing a large proximity spin-orbit coupling in graphene. Directly experimental evidence of a Dirac band gap opening induced by Cr_2O_3 is still lack. From this perspective, it is beneficial to direct describe band structure of ultrathin Cr_2O_3/graphene. Here, we report a observable giant π band splitting in ARPES experiment induced by depositing ultrathin Cr_2O_3 film on graphene(Gr)/Ni(111). We speculate the evolution of graphene π band from n-doping-type to splitting-type comes from a nontrivial sublattice-symmetry breaking.



[1]. A. Lodesani, A. Picone, *et al*, **ACS Nano**, 2019, 13, 4361.
[2]. H. Takenaka, S. Sandhoefner, *et al*, **Phys. Rev. B**, 2019, 100, 125156.