Theme : Functional Material

Subject : 2D Material

Introduction
The goal of this program is to understand the growth mechanism of 2D materials and graphene and to explore their potential applications. Ever since they were discovered, graphene and 2D materials have been attracted many attentions as candidate materials to extend Si technology due to their unique properties, such as high electron mobility, transparency, and flexibility. They have been considered as channel materials for high speed and/or flexible devices and component materials to improve the performance of conventional Si devices. In this program, we would like to investigate potential issues on the growth of 2D materials and/or graphene and to search for the new directions for the new applications. Also, we will consider any topics that are not listed below, as long as the topics are related to 2D materials and graphene.

Scope
Our main interests on the topic are as follows.
1. What would be the best device concepts/structures for 2D materials and/or graphene for high speed and/or flexible electronic and optoelectronic devices?
2. Can 2D materials and/or graphene be used for energy-related devices?
3. What would be the best way to grow monolayer and single crystalline 2D materials? How can we control the thickness and increase the domain sizes?
4. Can other materials be grown on 2D materials in high quality?
5. How can the contact resistances be minimized between metals and 2D materials/graphene?
6. What would be the best method to detect the defects and evaluate the defect levels in graphene? What would be the best way to measure the domain sizes? And how the tools can be developed?

Research questions
Our main interests on the topic are as follows.
7. What would be the best device concepts/structures for 2D materials and/or graphene for high speed and/or flexible electronic and optoelectronic devices?
8. Can 2D materials and/or graphene be used for energy-related devices?
9. What would be the best way to grow monolayer and single crystalline 2D materials? How can we control the thickness and increase the domain sizes?
10. Can other materials be grown on 2D materials in high quality?
11. How can the contact resistances be minimized between metals and 2D materials/graphene?
12. What would be the best method to detect the defects and evaluate the defect levels in graphene? What would be the best way to measure the domain sizes? And how the tools can be developed?

Expected Deliverables
Details are open for discussion.
1. New device concepts and structures for 2D materials and/or graphene
2. New growth methods for 2D materials and methods to increase the domain sizes
3. New growth methods for stack structures
4. Contact structures for metal and 2D materials/graphene
5. New method defect and domain size inspection for 2D materials and graphene