Carrier injection and transport in organic and inorganic nano materials

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Flow of electrons and holes with charge, so called as carrier, is very importnat for electric conduction as well as for thermal conduction. Thermal conduction can also be available via phonon mediation, and both electric and thermal conductions in addition to spin momentum flow, play a very important role for evergy conversion in materials science. In order to provide carriers into solid state materials, three types of methods can generally be employed: the first being replacement of elements in materials, the second being insersion of elements or molecules (intercalation process) into a space in a lattice, and the third is electric field induced effect generally used in field effect transistors (FETs). The former two are chemical approaches and the third is a physical one. In the first two categories, the approach by intercalation is of very importance especially in nano materials and organic mateirals since their ground states are generally categorized as the closed-shell electronic states and the carrier injection should be made without creating any large damage on their structure. The physical approach using transistor device strucrture, in the third classification, can be used both for organic and inorganic materials, where Intriguingly the injection limit of carriers is remarkably different beteen inorganic and organic materials.

In this workshp, I will describe the present sistuation and understanding on the carrier injection and the transport in inorganic and organic materials, especially forcusing on nano mateirals referring to our recent researches [1-5]. Followings are the topics to be presented in this workshop.

1. Carrier injection via intercalation process in inorganic and organic materials.
2. Carrier tuing and true electronic ground states in pure-carbon organic semiconductors.
3. Metal-semiconductor (MS) contact of transistor structure in inorganic and organic materials.

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