Temperature-dependent FET properties of dibenzo[n]phenacenes (n = 5 -7)

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A new type of phenacene-based polycyclic aromatic molecules, dibenzo[n]phenacenes (**DBnP**s) were successfully synthesized, which are recognised as acene-phenacene hybrid molecules. The values of effective field-effect mobility, μ_{eff}, of single crystal field-effect transistors (FETs) of **DBnP**s were evaluated to demonstrate that the FET performance of **DB6P** is superior to that of **DB5P** and **DB7P**.[1] The low value of field-effect mobility, μ, of organic FETs not only originates from the insufficient extension of π-conduction network over the channel region but also the extrinsic trap states formed between highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO). In order to quantitatively estimate the trap states generated at the interface between gate dielectrics and single crystals of **DBnP**s, as well as the channel transport, the temperature-dependent FET properties were investigated using the multiple trap and release (MTR) model.

As seen from Figure 1, the intrinsic mobility, μ_0, of **DB6P**, which refers to the maximum μ value without any extrinsic trap states, was evaluated to be 1.52 $cm^2 V^{-1} s^{-1}$. This value was higher than those of **DB5P** and **DB7P**, consistent with the fact that the value of μ_{eff} of **DB6P** was higher than those of **DB5P** and **DB7P**. These results indicate that **DB6P** is a good material from view of the channel transport, implying the formation of superior π-conduction network, which is recognized as an intrinsic factor ascribable to the molecule itself. Also, the ratio of the number of total trap states, N_t, with respect to that of valence states, N_v, of **DB6P** was much smaller than those of **DB5P** and **DB7P**, suggestive of lower trap states in **DB6P,** which is recognized as an extrinsic factor. The reason why **DB6P** is superior in both intrinsic and extrinsic aspects will be discussed in the meeting.

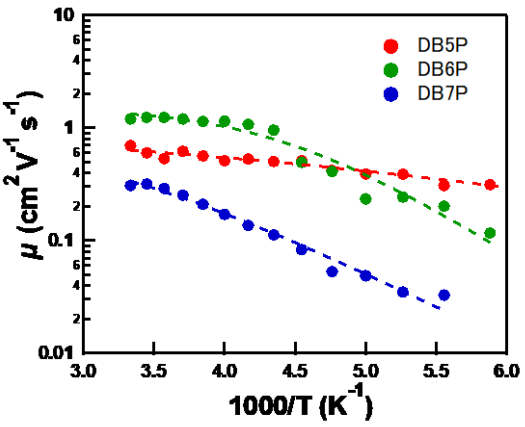

Figure 1. Plots of μ *versus* 1000 / *T* of **DBnP** single crystal FETs (**n** = **5 – 7**), together with the curves fitted with MTR model.

[1] Y. Zhang et al., *Chem. Commun.*, **2021**, 57, 4768-4771.