二次元層状物質 h-BN の挿入による Ni(111)と DBP の相互作用の変化

2D materials as decoupling layer: Investigation of the physical properties of DBP on Ni(111) with and without an h-BN interlayer

千葉大院工 [1], イェーナ大学 [2], 千葉大分子キ [3] ○相原 巧実 [1], Maximilian Schaal[2], Felix Otto[2], Marco Grünewald[2], Torsten Fritz[2], 吉田 弘幸 [1,3]

Chiba Univ.[1,3], Friedrich-Schiller-University Jena [2], ○T. Aihara[1], M. Schaal[2], F. Otto[2], M. Grünewald[2], T. Fritz[2], H. Yoshida[1,3]

E-Mail: t.aihara@chiba-u.jp

Two-dimensional (2D) materials have a significant impact on the design and application of functional materials since their first appearance. The presence of a 2D material affects the growth mode of an epitaxial thin film grown upon and its electronic states.[1] The versatility of molecular growth on 2D material interfaces has led to both fundamental research and prospective applications.

In this work, we examine the change of various properties such as the electronic states and the lateral structure of an organic adlayer, composed of DBP (tetraphenyldibenzoperiflanthene), due to the presence of an h-BN interlayer between the molecule and the Ni(111) substrate. The h-BN film was prepared by chemical vapor deposition (CVD) and checked by x-ray photoelectron spectroscopy (XPS). We used differential reflectance spectroscopy (DRS)[2] to monitor the deposition of the organic material. The electronic states were determined by ultraviolet photoelectron spectroscopy (UPS) and the lateral structure was measured by low energy electron diffraction (LEED).

Fig.1 shows the results of DRS which is measured during the deposition. Without an h-BN interlayer, the peak width is broader than that with the h-BN, indicating both a lack of hybridization and a higher structural order. This can be explained by the considerable weakening of the interaction between DBP and Ni(111) by the h-BN interlayer. The same trend is also observed in UPS, indicating the lack of hybridization. The higher structural order of the DBP films on h-BN/Ni(111) is confirmed by LEED (Fig.2), albeit with a strong rotational disorder. While Ni(111) LEED spots can be observed for both samples, a diffraction ring stemming from the DBP layer can only be found in the sample with h-BN.

From the results above, we can confirm that the insertion of h-BN promotes the electron decoupling between DBP and Ni(111) and induces a change of the molecular structure as well.

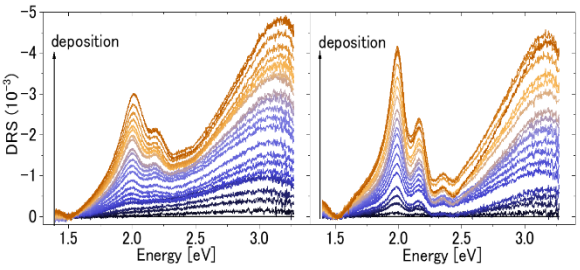

Fig.1: Results of DRS, (left) DBP on Ni(111), (right) DBP on h-BN on Ni(111)

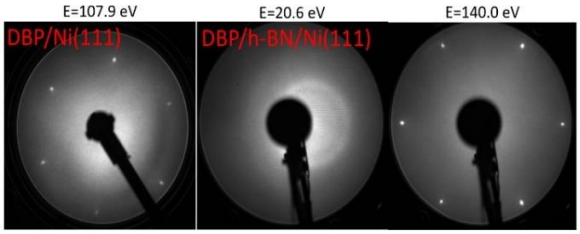

Fig.2: LEED patterns of (left) DBP on Ni(111) and (center and right) DBP on h-BN on Ni(111). Numbers on top indicate the beam energy.

[1] T. Tian et al., *Ind. Eng. Chem. Res.* **56**, 10552 (2017)
[2] R. Forker et al., *Annu. Rep. Prog. Chem. Sect. C: Rhys. Chem.*, **108**, 34 (2012)