Transfer of catalytic activity through h-BN monolayer for hydrogenation

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The hydrogenation of h-BN on metal substrates has been reported, since the reaction can be rationalized by considering the catalytic properties of the metal.¹ However, the dynamics of the hydrogenation depending on the surface orientation of metals have not been elucidated. Here we demonstrate the catalytic transparency of h-BN to Pt metal substrate for hydrogenation. We analysed extent of h-BN hydrogenation on various Pt single-oriented crystals via hydrogen plasma treatment; the rate of hydrogenation follows the order Pt (110) < Pt (111) < Pt (100). It revealed that the catalytic activity of Pt inducing the h-BN hydrogenation is related to the difference of adsorption energy of hydrogen on Pt surface orientation. The h-BN thickness-dependent experimental results have demonstrated that the monolayer h-BN has catalytic transparency to Pt surface for the hydrogenation. Moreover, we suggested that the h-BN nanomesh, formed by arrangement of h-BN on the metal surface, can be one of factor to explain different progress of h-BN hydrogenation on each Pt crystals. This tendency was also observed in conversion reaction of h-BN, since it is a phenomenon based on the hydrogenation of specific materials.

References

Figures

Figure 1: Degree of hydrogenation in h-BN as a function of plasma treatment time.

Figure 2: (a) Cross section of pristine h-BN nanomesh on Pt contains Pore and Wire region. N 1s spectra of h-BN nanomesh on three different single-oriented Pt crystals; (b) Pt (110), (c) Pt (111) and (d) Pt (100). The red and blue line indicate Wire and Pore component, respectively.