

## Dynamic Metal–Polymer Interaction: New Catalytic Phenomena Enabling the Design of Selective and Stable Hydrogenation Catalysts

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Metal catalysts have been generally supported on hard inorganic materials. Here we support Pd particles on a thermochemically stable but soft engineering plastic, polyphenylene sulfide (PPS), for the acetylene partial hydrogenation. Near the glass transition temperature of PPS (~353 K), the polymer chains completely cover the entire surface of Pd particles via strong metal–polymer interaction. The Pd–PPS enables H<sub>2</sub> activation only in the presence of acetylene that has a strong binding affinity to Pd and thus can disturb the Pd–PPS interface. When acetylene is hydrogenated to weakly binding ethylene, it is repelled from the Pd surface by re-adsorption of the PPS chain before over-hydrogenation. As a result, the catalyst enables selective partial hydrogenation of acetylene to ethylene even in an ethylene-rich stream. In addition, the strong Pd–PPS interaction repels coke precursors from the Pd surface, significantly suppressing catalytic deactivation. This result shows the unique possibility of using dynamic metal–polymer interactions in the design of chemoselective and long-lived catalysts.