Catalytic behavior of Pt nanoparticles on hexagonal boron nitride fibers as a truly inert support in the CO_2 hydrogenation reaction

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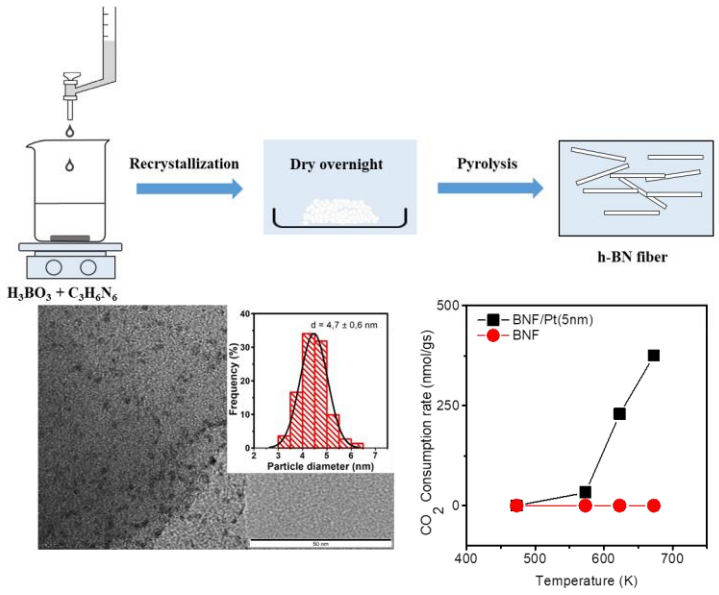
The investigation regarding the utilization of atmospheric CO_2, and its conversion into useful chemicals or fuels is a burning question. To develop the most efficient catalyst for this purpose, it is important to know the catalytic behavior of the pure support and the pure metal particles [1]. Hexagonal boron nitride fiber (h-BNF) is an ideal support for pure metal analysis due to its chemical inertness, high thermal stability, and high specific surface area. Furthermore, BNF shows no catalytic activity towards the CO_2 hydrogenation reaction. In our study, size-controlled (~4.7 ± 0.6 nm) Pt nanoparticles were impregnated on BNF, and the resulting catalyst was characterized by different surface science techniques and its activity was tested in the CO_2 hydrogenation reaction. The activity of the h-BN/Pt catalyst is lower than that of the SiO_2/Pt catalyst, which is widely used as a reference. XPS measurements did not reveal any electronic interaction between the Pt nanoparticles and the support. No aggregation of nanoparticles was observed based on TEM measurements. CO adsorption and DRIFTS measurements provide evidence that new sites are formed on the nanoparticles, which are responsible for the observed low catalytic activity of the Pt nanoparticles. Based on the above, it can be concluded that the h-BN structure is an ideal substrate to study the catalytic activity of the pure Pt nanoparticles.



[1] Ali M. Bahmanpour et al. Applied Catalysis B:Environmental **295** 120319 (2021)