Pt NANOPARTICLES ON INERT H-BN SUPPORT: INVESTIGATION OF THE CO_2 HYDROGENATION REACTION

Tímea Hegedűs[1], Imre Szenti[1], Anastasiia Efremova[1], Ákos Szamosvölgyi[1], Kornélia Baán[1], János Kiss[1,2], Kónya Zoltán[1,2]

[1]Interdisciplinary Excellence Centre, Department of Applied and Environmental Chemistry, University of Szeged, Rerrich Béla tér 1, H-6720 Szeged, Hungary
[2]HUN-REN-SZTE Reaction Kinetics and Surface Chemistry Research Group, Rerrich Béla tér 1, H-6720 Szeged, Hungary
e-mail: hegedustimea@chem.u-szeged.hu

Abstract

Metal nanoparticles, such as Pt were applied in catalysis on various support materials, and have been employed widely in the CO_2 activation reaction. The utilization of this greenhouse gas is a burning question. During catalyst design, it is important to know the behavior of metal nanoparticles and the support alone. The distinct catalytic activity of Pt without any interaction with the support material is unknown experimentally as the support always plays a role in the catalytic reaction [1]. As a chemically inert material, hexagonal boron nitride (h-BN) can be a candidate for this purpose [2]. Therefore, h-BN fibers were synthesized and characterized. The as-prepared fibers show no catalytic activity towards CO_2 hydrogenation. After, controlled-size (4.7 ± 0.6 nm) Pt nanoparticles were impregnated onto the fibers the catalytic activity was 377 nmol/gs at 400°C with almost 100% CO selectivity. DRIFTS measurements supported that the reaction mechanism observed fits the RWGS reaction mechanism. Various surface science techniques proved that the measured activity is attributed to the Pt nanoparticles alone. For the noticed low catalytic activity of Pt nanoparticles the development of new sites is responsible proved by CO vibration spectroscopy studies [3]. Thus, the synthesized h-BN fibers can be employed in catalytic investigations as reference material with the proposed metal and reaction or possibly under different conditions.

Acknowledgments

Supported by the "ÚNKP-23-4-SZTE-554" New National Excellence Program of the Ministry for Culture and Innovation from the source of the National Research, Development and Innovation Fund.

References

[1] S. Kattel, P. Liu, J.G. Chen, J. Am. Chem. Soc. 139 (2017) 9739–9754.
[2] W. Auwärter, Surf. Sci. Rep. 74 (2019) 1–95.
[3] C. Lentz, S.P. Jand, J. Melke, C. Roth, P. Kaghazchi, J. Mol. Catal. A Chem. 426 (2017) 1–9.