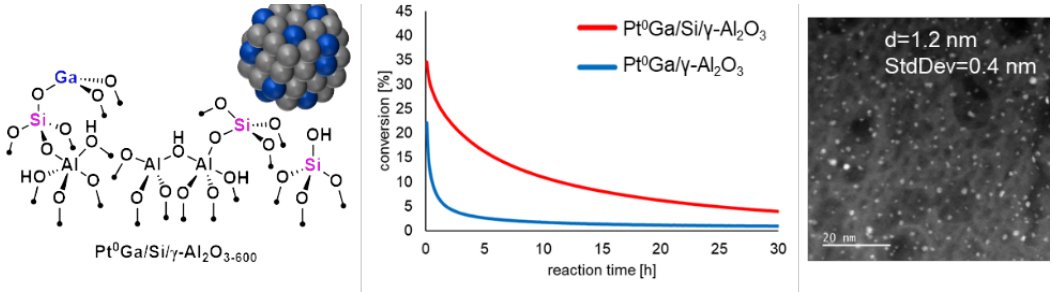
Investigation of Alumina-based Pt-Ga Systems for Non-Oxidative Propane Dehydrogenation Reaction

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Large scale exploitation of shale gas stimulates the developments of on-purpose propane dehydrogenation (PDH) technologies.[1-3] Both principal processes, based on Cr_2O_3/Al_2O_3 (Lummus Catofin process) and Pt-Sn/Al_2O_3 (UOP Oleflex process), are applied in industry, whereas constant and rapid regeneration are necessary to maintain high productivity. In the case of Pt-based industrial systems, metal promoters and/or additional dopants play important roles to enhance the catalytic properties and stability. In order to understand actual effects of promoters/additives, preparation of tailored systems through SOMC/TMP approach is a powerful methodology since it enables to evaluate surface active structure by using physicochemical and spectroscopic techniques. Silica-based PDH catalysts *via* SOMC/TMP approach have been reported,[4-6] whereas application of SOMC/TMP to alumina-based materials, which are more commonly used in industry, has not been addressed. Herein, we prepared Pt-Ga systems supported on alumina and Si doped alumina *via* SOMC technique, and Si doped Pt-Ga systems showed higher catalytic activity stability to PDH reaction. Considering from STEM-EDX and XAS results, Pt-Ga systems on Si doped alumina included well-dispersed and uniformly alloyed nanoparticles, leading enhanced catalytic properties.



[1] Malakoff, D. *Science* **2014**, *344*, 1464–1467.
[2] Sattler, J. J. H. B.; Ruiz-Martinez, J.; Santillan-Jimenez, E.; Weckhuysen, B. M. *Chem. Rev.* **2014**, *114*, 10613–10653.
[3] Docherty, S. R.; Rochlitz, L.; Payard, P. A.; Copéret, C. *Chem. Soc. Rev.* **2021**, *50*, 5806–5822.
[4] Searles, K.; Chan, K. W.; Mendes Burak, J. A.; Zemlyanov, D.; Safonova, O.; Copéret, C. *J. Am. Chem. Soc.* **2018**, *140*, 11674–11679.
[5] Rochlitz, L.; Searles, K.; Alfke, J.; Zemlyanov, D.; Safonova, O. V.; Copéret, C. Silica-Supported, *Chem. Sci.* **2020**, *11*, 1549–1555.
[6] Rochlitz, L.; Pessemesse, Q.; Fischer, J. W. A.; Klose, D.; Clark, A. H.; Plodinec, M.; Jeschke, G.; Payard, P. A.; Copéret, C. *J. Am. Chem. Soc.* **2022**, *144*, 13384–13393.