Understanding the formation of an active CO oxidation catalyst from an atomically precise Pt nanocluster precursor

Papri Chakraborty, [1,2] Marco Neumaier, [1] Johannes Seibel,[2] Artur Böttcher, [2] Nicola Da Roit, [3] Christian Schmitt, [3] Silke Behrens[3] and Manfred M. Kappes[1,2]

[1]Institute of Nanotechnology, Karlsruhe Institute of Technology, Hermann-von Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany, [2]Institute of Physical Chemistry, Karlsruhe Institute of Technology, Fritz-Haber-Weg 2, Karlsruhe 76131, Germany, [2] Institute of Catalysis Research and Technology, Karlsruhe Institute of Technology, Hermann-von Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany

E-Mail presenting author: papri.chakraborty@kit.edu, johannes.seibel@kit.edu

Abstract: In the past few decades, there has been substantial interest in developing noble metal (supported on metal oxides) based industrial catalysts for pollutant control. However, recent global developments require significant reduction in the amount of the noble metals to prepare the catalysts. Atomically precise Pt nanoclusters, co-protected by CO and triphenyl phosphine (TPP) ligands, e.g. $[Pt_{17}(CO)_{12}(TPP)_8]^{2+}$, can form an active catalyst for CO oxidation upon removal of the protecting ligands. [1,2] We study such catalytic reactions and obtain molecular level insights into the formation of the active catalysts through a combination of on-surface thermal decomposition, gas-phase studies on the isolated clusters and theoretical calculations to understand the structure evolution.

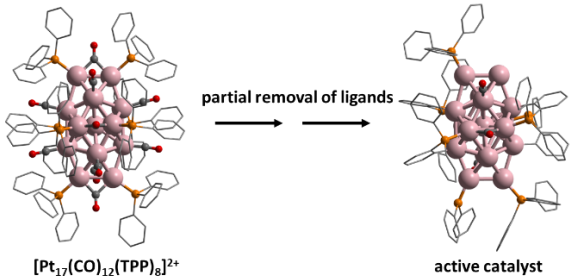

Figure 1: Schematic showing the formation of an active CO oxidation catalyst from a ligated Pt nanocluster.

References:

[1] L. V. Nair *et al.,* J. Phys. Chem. C, 2017, **121**, 11002−11009.

[2] Y. Negishi *et al.*, Nanoscale Adv. 2020, **2**, 669–678.