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Atomic-scale mapping of cerium valence in ceria-zirconia-supported Pd model planar catalysts[1] SHUYI ZHANG, MICHAEL KATZ, KAI SUN, University of Michigan, OBIEFUNE EZEKOYE, McKinsey & Company, MANJULA NANDASIRI, Pacific Northwest National Laboratory, HUNG-WEN JEN, Ford Motor Company, GEORGE GRAHAM, XIAOQING PAN, University of Michigan, UNIVERSITY OF MICHIGAN TEAM, PACIFIC NORTHWEST NATIONAL LABORATORY COLLABORATION, FORD MOTOR COMPANY COLLABORATION — Cerium-based oxides have long been regarded as an important class of catalyst support materials. It is also recognized that the interaction between precious metal and ceria-based support material enhances the reducibility of the ceria. The combination of scanning transmission electron microscopy (STEM) and electron energy loss spectroscopy (EELS) can provide an atomic-scale picture of the interaction between precious metal particles and their support material. In our work, aberration corrected STEM-EELS is used to study the valence of cerium in the vicinity of palladium nanoparticles supported on a ceria-zirconia (CZO) thin film. A monolayer-equivalent of Pd was deposited onto a 50nm-thick CZO thin film, which was then subjected to different thermal treatments. The EELS spectra extracted from the top several atomic layers of the CZO film exhibit typical 3+ character following a low-temperature reduction treatment, indicating the formation of oxygen vacancies. A variety of control experiments have also been performed to exclude possible artifacts caused by electron beam irradiation.

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