

### Promotion of Nano-sized Palladium to Enhance Carbon Tolerance of Ni

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The deactivation resulting from carbon dissolution includes the breakage of the Ni-Ni conducting network as well as the formation of microscopic cracks within the Ni-YSZ material. The microstructure of the Ni-YSZ cermet exposed to methane at 750 °C was investigated using a dual beam focused ion beam scanning electron microscopy (FIB-SEM) system and the deactivation process within the cermet was confirmed in the reconstructed microstructure prepared by FIB-SEM. Furthermore, promotion of precious metal nanoparticles (NPs) on the Ni-YSZ cermet was studied to improve the carbon tolerance of Ni. We prepared M-NPs (M = Pd) using a novel method, so-called a physical vapor deposition on powder (PVDP) and introduced them into Ni-YSZ cermets. We demonstrated that promotion of precious metal NPs effectively alleviated carbon deposition in Ni-YSZ anodes and these results were consistent with molecular insights obtained in the DFT calculations.