

## Effect of Pt substitution to Pd/Rh based three-way catalysts (TWCs) on thermal stability

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In recent five years, increasing usage of Pd for commercial TWC has pushed its price to the highest level compared to Pt (from yr2016: Pd \$500 vs. Pt \$950 to yr2021: Pd \$2380 vs. Pt \$1300). We characterized thermal stability as the primary concern in the TWC performance, focusing on the substitution of Pt to the typical Pd/Rh TWC formulation. We evaluated six aged commercial TWCs consisting of the Pd/Rh based and partially substituted Pt/Pd/Rh TWCs employed as a function of the location of the catalytic converter (WCC front, WCC rear, and UCC) and the PGM loading. The reactor data showed that the aged Pd/Rh catalysts were less deactivated than aged Pt/Rh catalysts. The series of catalysts with low PGM loading exhibited similar thermal stability for TWC performance, regardless of the presence of Pt except for the C<sub>3</sub>H<sub>8</sub> oxidation. For high PGM loading TWCs placed in front warming-up brick, aged catalytic performance was strongly affected by the presence of Pt. The Pt substituted Pt/Pd/Rh catalyst showed superior thermal stability than the Pd/Rh catalyst. This study provides possible guidance in applying the Pt substituted TWC with reduced cost and improved thermal stability.