Supporting Information

Recent Advances in Gasoline Three-Way Catalyst Formulation – A Review

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Table S1. Varying washcoat composition and reported T_{10} and T_{50} values from literature. (1/6)

Composition	CO		HC		NO		NO_2		Aging conditions	Ref.
	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)		
1% Pd/(Al_2O_3) (0.5% CO/250ppm HC)	193	216	172	224	-	-	-	-	Not aged	17
1% Pd/($Ce_xZr_yO_2$) (0.5% CO/250ppm HC)	95	157	176	208	-	-	-	-		
1% Pd/(Al_2O_3) (1.0% CO/500ppm HC)	209	225	191	270	-	-	-	-		
1% Pd/($Ce_xZr_yO_2$) (1.0% CO/500ppm HC)	127	164	193	226	-	-	-	-		
0.5% Pt/(Al_2O_3)	453	530	453	510	400	350	-	-	1000 °C in air, 3 h	19
0.5% Pt/(0.3CeO_2 + Al_2O_3)	268	350	360	430	360	420	-	-		
0.5% Pt/(0.3($Ce_{0.8}Zr_{0.2}O_2$) + Al_2O_3)	289	350	351	420	340	440	-	-		
1% Pd/(Al_2O_3/CeO_2/ZrO_2)	282	308	287	308	309	-	-	-	1050 °C, redox, 36 h	20
1% Pd/(Al_2O_3 + CeO_2/ZrO_2)	282	323	292	323	350	-	-	-		
(120 g/L Al_2O_3)/(60 g/L CeZrY); Pt deposited on Al_2O_3	-	248	-	256	-	251	-	-	900 °C, redox conditions 50 h	21
(120 g/L Al_2O_3)/(60 g/L CeZrY); Pt deposited on CeZrY	-	241	-	247	-	251	-	-		
(120 g/L Al_2O_3)/(60 g/L CeZr; Pt deposited on CeZr	-	304	-	307	-	327	-	-		
(80 g/L Al_2O_3)/(60 g/L CeZrY)/(40 g/L ZrO_2); Pt dep. on ZrO_2	-	263	-	275	-	279	-	-		
(80 g/L Al_2O_3)/(60 g/L CeZrY)/(40 g/L TiO_2); Pt dep. on TiO_2	-	323	-	325	-	325	-	-		
0.5% Pd/($Ce_{0.2}Zr_{0.8}O_2$)	-	140	-	304	-	161	-	-	Not aged	28
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$)	-	114	-	289	-	143	-	-		
0.5% Pd/($Ce_{0.8}Zr_{0.2}O_2$)	-	120	-	295	-	143	-	-		
0.5% Pd/($Ce_{0.2}Zr_{0.8}O_2$ + $Ce_{0.8}Zr_{0.2}O_2$)	-	110	-	289	-	131	-	-		
0.5% Pd/($Ce_{0.2}Zr_{0.8}O_2$)	-	215	-	432	-	266	-	-	1000 °C in air, 5 h	
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$)	-	185	-	370	-	238	-	-		
0.5% Pd/($Ce_{0.8}Zr_{0.2}O_2$)	-	215	-	415	-	255	-	-		
0.5% Pd/($Ce_{0.2}Zr_{0.8}O_2$ + $Ce_{0.8}Zr_{0.2}O_2$)	-	178	-	347	-	220	-	-		

Table S1. Varying washcoat composition and reported T_{10} and T_{50} values from literature. (2/6)

Composition	CO		HC		NO		NO_2		Aging conditions	Ref.
	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)		
0.4% PtRh/($Ce_{0.35}Zr_{0.60}Nd_{0.05}O_2$)	223	242	260	289	248	278	-	-	Not aged	30
0.4% PtRh/($Ce_{0.35}Zr_{0.55}Nd_{0.10}O_2$)	142	160	230	259	190	211	-	-		
0.4% PtRh/($Ce_{0.35}Zr_{0.50}Nd_{0.15}O_2$)	140	170	228	259	186	217	-	-		
0.4% PtRh/($Ce_{0.35}Zr_{0.45}Nd_{0.20}O_2$)	151	179	230	258	180	240	-	-		
0.4% PtRh/($Ce_{0.35}Zr_{0.40}Nd_{0.25}O_2$)	163	191	238	262	202	231	-	-		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$)	-	159	-	229	-	205	-	180	Not aged	31
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 3 wt. % Nd)	-	167	-	226	-	210	-	174		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 5 wt. % Nd)	-	184	-	218	-	206	-	170		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 8 wt. % Nd)	-	186	-	224	-	188	-	165		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 10 wt. % Nd)	-	188	-	227	-	187	-	160		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$)	-	265	-	372	-	360	-	315	1100 °C, 4 h	
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 3 wt. % Nd)	-	259	-	340	-	347	-	275		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 5 wt. % Nd)	-	254	-	307	-	316	-	263		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 8 wt. % Nd)	-	226	-	333	-	330	-	220		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 10 wt. % Nd)	-	218	-	337	-	335	-	216		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$)	-	159	-	229	-	205	-	180	Not aged	32
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 3 wt. % Pr)	-	157	-	222	-	190	-	164		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 5 wt. % Pr)	-	153	-	212	-	176	-	157		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 8 wt. % Pr)	-	152	-	200	-	174	-	157		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 10 wt. % Pr)	-	147	-	199	-	172	-	156		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$)	-	265	-	372	-	360	-	315	1100 °C, 4 h	
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 3 wt. % Pr)	-	252	-	347	-	365	-	289		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 5 wt. % Pr)	-	252	-	340	-	353	-	279		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 8 wt. % Pr)	-	203	-	332	-	336	-	203		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 10 wt. % Pr)	-	203	-	327	-	322	-	203		

Table S1. Varying washcoat composition and reported T_{10} and T_{50} values from literature. (3/6)

Composition	CO		HC		NO		NO_2		Aged?	Ref.
	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$)	-	159	-	229	-	205	-	180	Not aged	33
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 3 wt. % La)	-	166	-	248	-	221	-	178		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 5 wt. % La)	-	181	-	215	-	213	-	187		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 8 wt. % La)	-	184	-	234	-	208	-	187		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 10 wt. % La)	-	185	-	237	-	205	-	187		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$)	-	265	-	372	-	360	-	315	1100 °C, 4 h	
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 3 wt. % La)	-	243	-	330	-	340	-	259		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 5 wt. % La)	-	239	-	282	-	280	-	240		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 8 wt. % La)	-	227	-	292	-	320	-	225		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 10 wt. % La)	-	219	-	304	-	328	-	218		
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 5 wt. % Sm)	-	278	-	385	-	403	-	297	1100 °C, 4 h	34
0.5 % Pd/($Ce_{0.2}Zr_{0.8}O_2$ 5 wt. % Y)	-	288	-	412	-	466	-	309		
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$)	-	-	-	250	-	228	-	187	Not aged	35
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 11 mol % La)	-	-	-	241	-	214	-	185		
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 11 mol % Nd)	-	-	-	252	-	211	-	185		
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 11 mol % Pr)	-	-	-	252	-	204	-	171		
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 11 mol % Sr)	-	-	-	241	-	218	-	180		
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 11 mol % Y)	-	-	-	252	-	224	-	187		
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$)	-	-	-	280	-	287	-	225	1100 °C, 4 h	
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 11 mol % La)	-	-	-	276	-	282	-	209		
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 11 mol % Nd)	-	-	-	267	-	267	-	198		
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 11 mol % Pr)	-	-	-	273	-	278	-	186		
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 11 mol % Sr)	-	-	-	276	-	278	-	207		
0.5% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 11 mol % Y)	-	-	-	273	-	276	-	203		

Table S1. Varying washcoat composition and reported T_{10} and T_{50} values from literature. (4/6)

Composition	CO		HC		NO		NO_2		Aged?	Ref.
	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)		
1% Pd/(0.4CeO_2/0.5ZrO_2/0.05La_2O_3/0.05Y_2O_3)	-	147	-	285	-	161	-	-	Not aged	36
1% Pd/(0.4CeO_2/0.5ZrO_2/0.05La_2O_3/0.05Nd_2O_3)	-	131	-	284	-	144	-	-		
1% Pd/(0.4CeO_2/0.5ZrO_2/0.05La_2O_3/0.05Pr_2O_3)	-	142	-	288	-	155	-	-		
1% Pd/(0.4CeO_2/0.5ZrO_2/0.05La_2O_3/0.05Y_2O_3)	-	190	-	300	-	215	-	-	1000 °C in air, 4 h	
1% Pd/(0.4CeO_2/0.5ZrO_2/0.05La_2O_3/0.05Nd_2O_3)	-	174	-	300	-	197	-	-		
1% Pd/(0.4CeO_2/0.5ZrO_2/0.05La_2O_3/0.05Pr_2O_3)	-	185	-	355	-	206	-	-		
0.7 g/L Pt+Rh/($Ce_{0.35}Zr_{0.55}Y_{0.1}O_2$)/(3 % La_2O_3+Al_2O_3)	<140	180	200	232	<160	199	-	-	Not aged	37
0.7 g/L Pt+Rh/($Ce_{0.35}Zr_{0.55}La_{0.1}O_2$)/(3 % La_2O_3+Al_2O_3)	<140	175	190	228	160	194	-	-		
0.7 g/L Pt+Rh/($Ce_{0.35}Zr_{0.50}Y_{0.075}La_{0.075}O_2$)/(3 % La_2O_3+Al_2O_3)	144	167	180	219	<160	190	-	-		
0.7 g/L Pt+Rh/($Ce_{0.35}Zr_{0.55}Y_{0.1}O_2$)/(3 % La_2O_3+Al_2O_3)	220	241	263	287	247	260	-	-	1000 °C, hydrothermal, 5 h	
0.7 g/L Pt+Rh/($Ce_{0.35}Zr_{0.55}La_{0.1}O_2$)/(3 % La_2O_3+Al_2O_3)	<200	241	226	280	<220	257	-	-		
0.7 g/L Pt+Rh/($Ce_{0.35}Zr_{0.50}Y_{0.075}La_{0.075}O_2$)/(3 % La_2O_3+Al_2O_3)	<180	205	220	265	<200	237	-	-		
0.5 % Pt/(0.8Al_2O_3)(0.2$Ce_{0.4}Zr_{0.5}La_{0.1}O_{1.95}$)	-	344	-	365	-	365	-	-	Not aged	38
2.25% Pt/Rh commercial catalyst	-	300	-	318	-	328	-	-		
0.5 % Pt/(0.8Al_2O_3)(0.2$Ce_{0.4}Zr_{0.5}La_{0.1}O_{1.95}$) ($H_2O$/$CO_2$ in exhaust)	-	225	-	286	-	324	-	-		
2.25% Pt/Rh commercial catalyst (H_2O/CO_2 in exhaust)	-	225	-	305	-	305	-	-		
0.5 % Pt/(0.8Al_2O_3)(0.2$Ce_{0.4}Zr_{0.5}La_{0.1}O_{1.95}$)	-	453	-	500	-	500	-	-	900 °C in air, 5 h	
2.25% Pt/Rh commercial catalyst, aged	-	357	-	368	-	388	-	-		
0.5 % Pt/(0.8Al_2O_3)(0.2$Ce_{0.4}Zr_{0.5}La_{0.1}O_{1.95}$) ($H_2O$/$CO_2$ in exhaust)	-	357	-	282	-	516	-	-		
2.25% Pt/Rh commercial catalyst, aged (H_2O/CO_2 in exhaust)	-	388	-	429	-	525	-	-		
(1.2 g/L Pd)/($Ce_{0.6}Zr_{0.3}Y_{0.1}O_2$)	164	182	177	197	183	195	-	-	Not aged	73
0.5 % Rh/(ZrO_2)	177	232	226	306	200	261	-	-	900 °C in air, 5 h	39
0.5 % Rh/(5 mol% Y_2O_3/ZrO_2)	166	211	221	287	200	261	-	-		
0.5 % Rh/(5 mol% Pr_6O_{11}/ZrO_2)	266	432	335	575	291	443	-	-		

Table S1. Varying washcoat composition and reported T_{10} and T_{50} values from literature. (5/6)

Composition	CO		HC		NO		NO_2		Aged?	Ref.
	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)		
0.5 % Rh/(3 mol% Y_2O_3/ZrO_2)	207	253	274	322	252	272			900 °C in air, 5 h	41
0.5 % Rh/(3 mol% Y_2O_3/5 mol % CeO_2/ZrO_2)	192	223	246	298	224	250				
0.5 % Rh/(3 mol% Y_2O_3/10 mol % CeO_2/ZrO_2)	192	223	274	322	280	309				
0.5 % Rh/(3 mol% Y_2O_3/20 mol % CeO_2/ZrO_2)	192	223	274	325	284	315				
0.5% Rh/CeO_2	192	253	294	330	267	309				
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$)	90	104	277	354	254	365	150	207	Not aged	42
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 3 wt. % BaO)	115	155	176	242	164	219	138	166		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 5 wt. % BaO)	125	170	202	250	164	209	124	157		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 9 wt. % BaO)	144	182	231	284	173	266	138	184		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$)	<150	182	290	239	218	348	<150	213	1100 °C in air, 4h	
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 3 wt. % BaO)	<150	187	175	267	175	316	152	196		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 5 wt. % BaO)	150	199	214	260	190	247	<150	187		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 9 wt. % BaO)	<150	202	185	302	180	275	<150	192		
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3)	<200	232	<220	249	223	248	-	-	Not aged	43
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3, 4 wt. % BaO)	<200	226	<220	243	222	245	-	-		
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3, 6 wt. % BaO)	<200	223	<220	241	<220	237	-	-		
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3, 8 wt. % BaO)	<200	220	<220	235	<220	231	-	-		
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3, 10 wt. % BaO)	<200	238	<220	245	225	250	-	-		
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3)	<260	280	<280	320	<260	309	-	-	1000 °C for 5 h	
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3, 4 wt. % BaO)	<260	276	<280	311	<260	294	-	-		
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3, 6 wt. % BaO)	<260	270	<280	306	<260	283	-	-		
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3, 8 wt. % BaO)	<260	268	<280	302	<260	260	-	-		
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3, 10 wt. % BaO)	<260	297	<280	311	<260	300	-	-		

Table S1. Varying washcoat composition and reported T_{10} and T_{50} values from literature. (6/6)

Composition	CO		HC		NO		NO_2		Aged?	Ref.
	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)		
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3)	-	255	-	249	-	246	-	-	Not aged	44
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3, 6 wt. % SrO)	-	238	-	240	-	241	-	-		
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3)	-	300	-	318	-	309	-	-	1000 °C, air 5 h	
0.5% Pd/($Ce_{0.5}Zr_{0.5}O_2$/Al_2O_3, 6 wt. % SrO)	-	295	-	306	-	286	-	-		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$)	90	100	288	354	254	374	144	204	Not aged	45
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 3 wt. % Mg)	164	172	185	275	188	275	152	180		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 3 wt. % Ca)	154	175	205	269	188	269	156	180		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 3 wt. % Sr)	126	164	181	250	188	250	141	171		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 3 wt. % Ba)	115	156	185	244	166	219	141	163		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$)	<150	181	296	332	225	351	<150	212	1100 °C in air, 4h	
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 3 wt. % Mg)	212	238	288	387	289	400	224	243		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 3 wt. % Ca)	<150	186	190	310	166	330	150	180		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 3 wt. % Sr)	180	194	181	310	184	320	177	200		
1% Pd/($Ce_{0.67}Zr_{0.33}O_2$, 3 wt. % Ba)	159	186	181	301	178	317	150	194		

Table S2. TWC experimental parameters reported in literature.

CO	C_3H_6	C_3H_8	NO	NO_2	H_2O	CO_2	O_2	H_2	Balance gas	GHSV (h^{-1})	Ref.
0.60%	-	0.03%	0.06%	-	10%	12%	stoich.	-	N_2	38000	[28]
0.30%	0.04%	-	0.10%	-	2%	-	0.33%	0.10%	N_2	300000 mL g^{-1} h^{-1}	[19,53]
0.75%	0.067%	0.033%	0.10%	0.03%	-	-	0.75%	-	Ar	43000	[31–35,42,45]
1%	-	0.04%	0.05%	-	-	10%	a/f 14.0	-	-	200 L h^{-1}	[74]
0.646%	-	0.081%	0.10%	-	10%	12%	stoich.	-	N_2	34000	[30]
0.56%	0.024%	0.012%	0.10%	-	10%	12%	stoich.	0.19%	N_2	40000	[43,44]
0.56%	-	0.03%	0.06%	-	10%	12%	stoich.	-	N_2	40000	[36]
0.70%	0.067%	-	0.10%	-	-	-	0.78%	-	He	50500	[38]
0.86%	-	0.06%	0.12%	-	10%	12%	stoich.	-	N_2	34000	[37]
0.30%	0.035%	0.015%	0.15%	-	10%	-	0.31%	-	He	240000	[63,66]
1.15%	0.10%	0.025%	1.60%	-	10%	9.35%	1.15%	0.40%	N_2	70000	[55]
1%	0.05%	-	0.05%	-	10%	10%	1%	0.30%	Ar	100000	[57]

Table S3. Varying PGM loadings and reported T_{10} and T_{50} values from literature. (1/3)

Composition	CO		C_3H_6		C_3H_8		NO or NO_x		Aging conditions	Ref.
	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)		
0 g/ft^3 Pt ; 35 g/ft^3 Pd ; 5.0 g/ft^3 Rh	-	-	-	365	-	371	-	-	Johnson Matthey 160000 km road eqivalent aging program	54
0 g/ft^3 Pt ; 15 g/ft^3 Pd ; 5.0 g/ft^3 Rh	-	-	-	377	-	375	-	-		
0 g/ft^3 Pt ; 25 g/ft^3 Pd ; 5.0 g/ft^3 Rh	-	-	-	370	-	374	-	-		
0 g/ft^3 Pt ; 25 g/ft^3 Pd ; 7.5 g/ft^3 Rh	-	-	-	354	-	356	-	-		
0 g/ft^3 Pt ; 25 g/ft^3 Pd ; 2.0 g/ft^3 Rh	-	-	-	376	-	379	-	-		
35 g/ft^3 Pt ; 0 g/ft^3 Pd ; 5.0 g/ft^3 Rh	-	-	-	379	-	376	-	-		
15 g/ft^3 Pt ; 0 g/ft^3 Pd ; 5.0 g/ft^3 Rh	-	-	-	375	-	375	-	-		
25 g/ft^3 Pt ; 0 g/ft^3 Pd ; 5.0 g/ft^3 Rh	-	-	-	380	-	381	-	-		
25 g/ft^3 Pt ; 0 g/ft^3 Pd ; 7.5 g/ft^3 Rh	-	-	-	362	-	360	-	-		
25 g/ft^3 Pt ; 0 g/ft^3 Pd ; 2.0 g/ft^3 Rh	-	-	-	383	-	386	-	-		
0.01 % Rh/($ZrCeYLaO_2$)	-	305	-	-	-	-	-	324	Not aged	55
0.05 % Rh/($ZrCeYLaO_2$)	-	269	-	288	-	-	-	280		
0.10 % Rh/($ZrCeYLaO_2$)	-	254	-	269	-	-	-	263		
0.25 % Rh/($ZrCeYLaO_2$)	-	232	-	246	-	-	-	242		
0.50 % Rh/($ZrCeYLaO_2$)	-	214	-	228	-	-	-	226		
0.75 % Rh/($ZrCeYLaO_2$)	-	202	-	218	-	-	-	215		
1 % Rh/($ZrCeYLaO_2$)	-	197	-	208	-	-	-	206		
0.01 % Rh/($ZrCeYLaO_2$)	-	-	-	-	-	-	-	-	1000 to 1100 °C, 4 h	
0.05 % Rh/($ZrCeYLaO_2$)	-	382	-	-	-	-	-	-		
0.10 % Rh/($ZrCeYLaO_2$)	-	341	-	-	-	-	-	351		
0.25 % Rh/($ZrCeYLaO_2$)	-	337	-	372	-	-	-	323		
0.50 % Rh/($ZrCeYLaO_2$)	-	318	-	339	-	-	-	305		
0.75 % Rh/($ZrCeYLaO_2$)	-	304	-	323	-	-	-	294		
1 % Rh/($ZrCeYLaO_2$)	-	295	-	307	-	-	-	289		

Table S3. Varying PGM loadings and reported T_{10} and T_{50} values from literature. (2/3)

Composition	CO		C_3H_6		C_3H_8		NO or NO_x		Aging conditions	Ref.
	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)		
0.10% Pd/commercial catalyst (20 g/ft^3 Pd)	202	234	218	243	-	-	-	-	GM 4000 mile equivalent aging program	57
0.26% Pd/commercial catalyst (50 g/ft^3 Pd)	194	222	201	228	-	-	-	-		
0.42% Pd/commercial catalyst (80 g/ft^3 Pd)	176	202	189	221	-	-	-	-		
0.86% Pd/commercial catalyst (160 g/ft^3 Pd)	166	199	183	207	-	-	-	-		
1.24% Pd/commercial catalyst (240 g/ft^3 Pd)	166	195	178	199	-	-	-	-		
Rh/Pd 1/9 (2.744 g/L total)	-	252	-	284	-	-	-	-	900 °C in air (2 h) cooled to 300, 900 °C in air+19% H_2O (2 h)	58
Rh/Pd 1/13.5 (3.98 g/L total)	-	260	-	272	-	-	-	-		
Rh/Pd 1/18 (5.214 g/L total)	-	216	-	261	-	-	-	-		
Rh/Pd 1/22.5 (6.45 g/L total)	-	232	-	295	-	-	-	-		
Rh/Pd/Pt 1/9/3.5 (3.706 g/L total)	-	270	-	304	-	-	-	-		
Rh/Pd/Pt 1/3.5/9 (3.706 g/L total)	-	300	-	330	-	-	-	-		
Rh/Pd 0.83/12.5 (3.55 g/L total)	-	260	-	284	-	-	-	-		
Rh/Pd 1.25/12.5 (3.67 g/L total)	-	245	-	284	-	-	-	-		
0.1 % Pd/($Al2O_3$)	193	214	-	-	-	-	-	-	Not aged	59
1 % Pd/($Al2O_3$)	166	182	-	-	-	-	-	-		
2 % Pd/($Al2O_3$)	159	173	-	-	-	-	-	-		
3 % Pd/($Al2O_3$)	159	171	-	-	-	-	-	-		
4 % Pd/($Al2O_3$)	159	171	-	-	-	-	-	-		
5 % Pd/($Al2O_3$)	159	171	-	-	-	-	-	-		
0.05% Pd/($Al2O_3$)	250	278	-	-	-	-	279	294	Not aged	60
0.5% Pd/($Al2O_3$)	192	220	-	-	-	-	162	220		
1.0% Pd/($Al2O_3$)	162	205	-	-	-	-	<27	140		
0.7% Pd/($Al2O_3$)	-	-	-	-	-	-	252	332	Not aged	61
0.7% Pd/(10% $Ce_{0.6}Zr_{0.4}O_2$ / 90% Al_2O_3)	-	-	-	-	-	-	180	327		
2.8% Pd/(10% $Ce_{0.6}Zr_{0.4}O_2$ / 90% Al_2O_3)	-	-	-	-	-	-	157	213		

Table S3. Varying PGM loadings and reported T_{10} and T_{50} values from literature. (3/3)

Composition	CO		C_3H_6		C_3H_8		NO or NO_x		Aging conditions	Ref.
	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)	T10 (°C)	T50 (°C)		
0.6% Pt-Rh/($Ce_{0.5}Zr_{0.5}O_2$) (Pt/Rh ratio 1.6/1)	257	308	-	-	-	-	-	-	700 °C in air, 3 h	62
1.0% Pt-Rh/($Ce_{0.5}Zr_{0.5}O_2$) (Pt/Rh ratio 3/1)	183	214	-	-	-	-	-	-		
0.08% Rh/(Al_2O_3)	171	206	270	311	331	377	195	247	Not aged	66
0.12% Pd/(Al_2O_3)	288	350	311	362	373	405	325	351		
0.2 % Pd-Rh/(Al_2O_3) (Pd-Rh 3/2 mechanical mixture)	215	250	266	298	317	373	250	306		
0.2 % Pd-Rh/(Al_2O_3) (Pd-Rh 3/2 alloy)	177	234	270	311	327	394	228	275		
0.2 % Pd-Rh/(Al_2O_3) (Pd/Rh = 3/2)	245	387	293	329	336	439	289	329	Not aged	63
0.2 % Pd-Rh/(Al_2O_3) (Pd/Rh = 7/3)	245	300	287	342	356	419	306	380		
0.2 % Pd-Rh/(Al_2O_3) (Pd/Rh = 4/1)	254	344	293	346	356	415	316	389		
0.5 % Rh/($Ce_{0.2}Zr_{0.8}O_2$)	156	239	251	337	-	-	237	314	Not aged	53
0.5 % Ir-Rh/($Ce_{0.2}Zr_{0.8}O_2$) (Ir/Rh = 1/9)	135	200	200	254	-	-	185	223		
0.5 % Ir-Rh/($Ce_{0.2}Zr_{0.8}O_2$) (Ir/Rh = 1/4)	156	239	251	337	-	-	237	331		
0.5 % Ir-Rh/($Ce_{0.2}Zr_{0.8}O_2$) (Ir/Rh = 1/1)	187	246	251	337	-	-	220	289		
0.5 % Ir-Rh/($Ce_{0.2}Zr_{0.8}O_2$) (Ir/Rh = 4/1)	210	263	251	375	-	-	220	314		
0.5 % Ir/(Ce0.2Zr0.8O2)	210	295	291	388	-	-	220	289		
0.1 % Ir-Rh/($Ce_{0.2}Zr_{0.8}O_2$) (Ir/Rh = 1/9)	-	267	-	408	-	-	-	357		
0.2 % Ir-Rh/($Ce_{0.2}Zr_{0.8}O_2$) (Ir/Rh = 1/9)	-	240	-	379	-	-	-	323		
0.3 % Ir-Rh/($Ce_{0.2}Zr_{0.8}O_2$) (Ir/Rh = 1/9)	-	230	-	360	-	-	-	318		
0.4 % Ir-Rh/($Ce_{0.2}Zr_{0.8}O_2$) (Ir/Rh = 1/9)	-	220	-	341	-	-	-	282		

Supporting Information References

73. Yucai H. Hydrothermal synthesis of nano Ce-Zr-Y oxide solid solution for automotive three-way catalyst. *J Am Ceram Soc* 2006; 89: 2949–2951.
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