Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Enhanced properties of Pd/CeO_2-nanorods modified with alkaline-earth metals for catalytic oxidation of low-concentration methane

Tianyu Guo[a,b,#], Xiaorong Nie[c,#], Jianping Du[b,c*], Jinping Li [b,d*]

[a]College of Environmental Science and Engineering, Taiyuan University of Technology, 030024 Shanxi, PR China

[b]Shanxi Key Laboratory of Gas Energy Efficient and Clean Utilization, 030024 Shanxi, PR China

[c] College of Chemistry and Chemical Engineering, Taiyuan University of Technology, 030024 Shanxi, PR China

[d] Research Institute of Special Chemicals, Taiyuan University of Technology, 030024 Shanxi, PR China

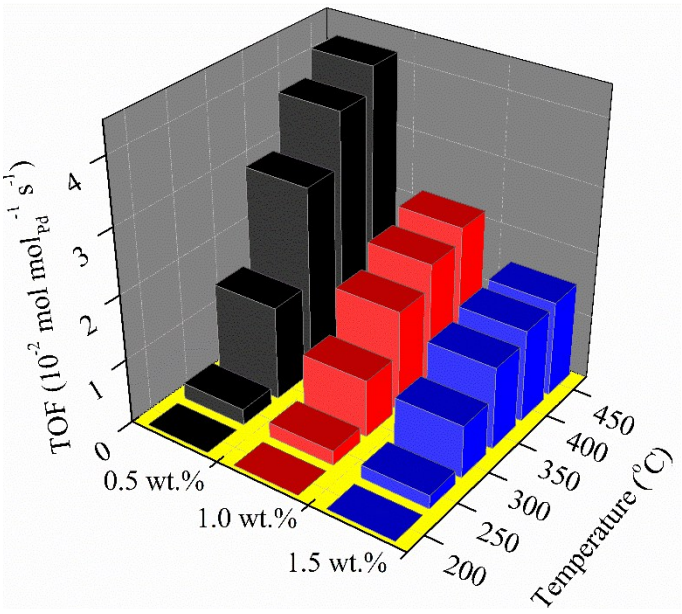

Fig.S1 Activities of the Pd/CeO_2-ND catalysts with various Pd contents at different temperatures

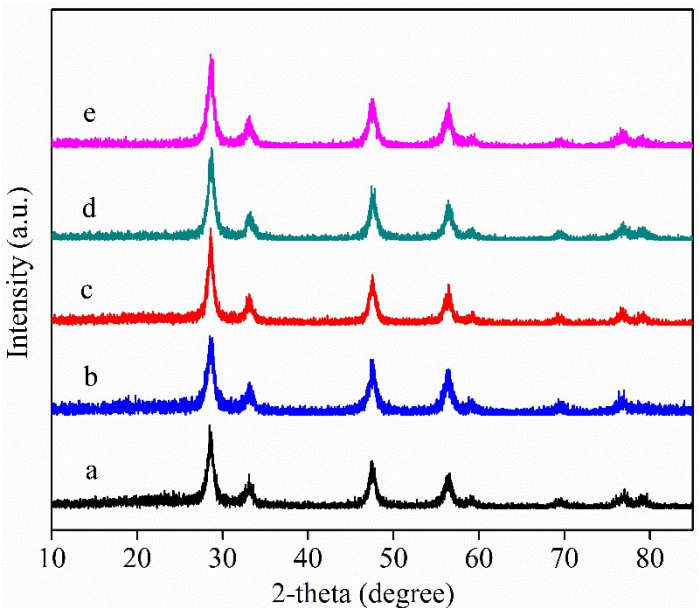

Fig.S2 XRD patterns of the PdM/CeO_2-ND catalysts: (a) Pd/CeO_2-ND, (b) PdMg/CeO_2-ND, (c) PdCa/CeO_2-ND, (d) PdSr/CeO_2-ND and (e) PdBa/CeO_2-ND

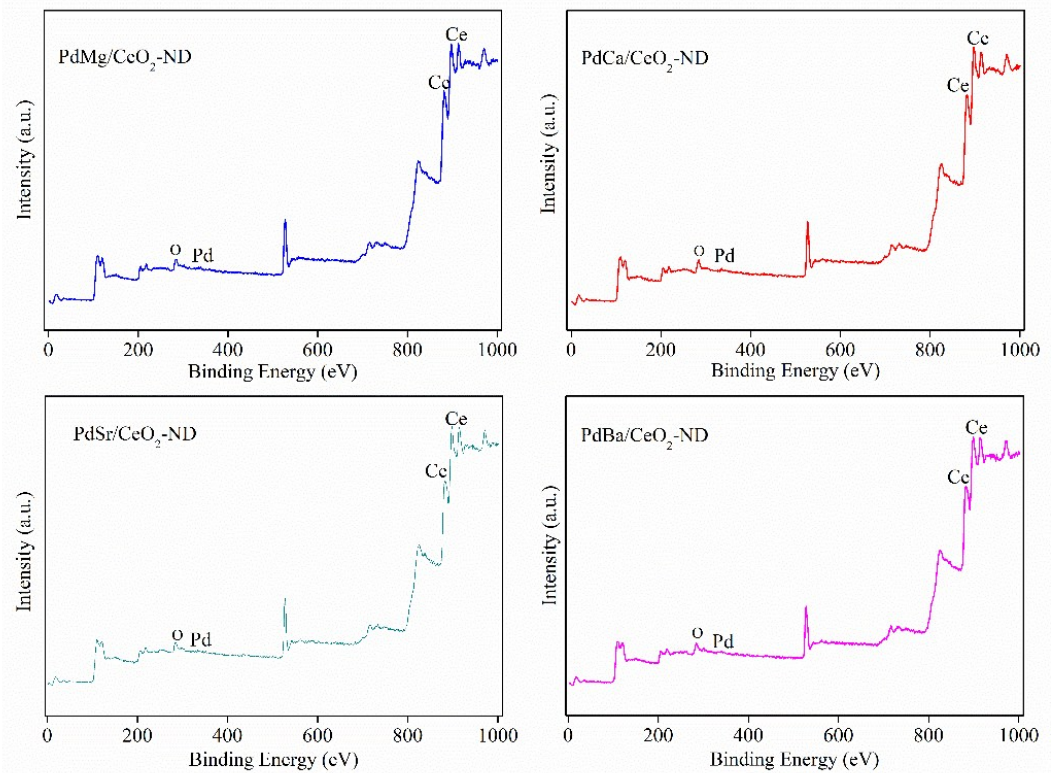

Fig.S3 XPS spectra of the PdM/CeO_2-ND catalysts

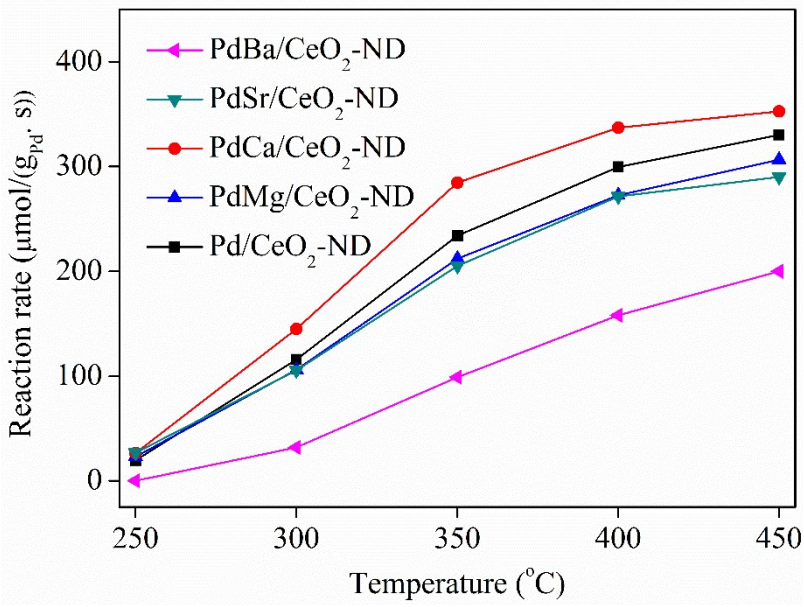

Fig.S4 Methane oxidation rate as a function of temperature over the PdM/CeO_2-ND catalysts

Table S1 Catalytic activities of the PdM/CeO_2-ND catalysts for methane oxidation

Catalyst	Methane oxidation			Methane oxidation at 340 °C	
	$T_{10\%}$ (°C)	$T_{50\%}$ (°C)	$T_{90\%}$ (°C)	CH_4 conversion (%)	Reaction rate ($\times 10^{-6}$mol g_{Pd}^{-1} s^{-1})
Pd/CeO_2-ND	260	328	444	58.52	211.25
PdMg/CeO_2-ND	260	336	>450	52.62	191.38
PdCa/CeO_2-ND	255	313	390	70.59	257.53
PdSr/CeO_2-ND	257	339	>450	51.05	185.96
PdBa/CeO_2-ND	303	428	>450	23.51	86.59

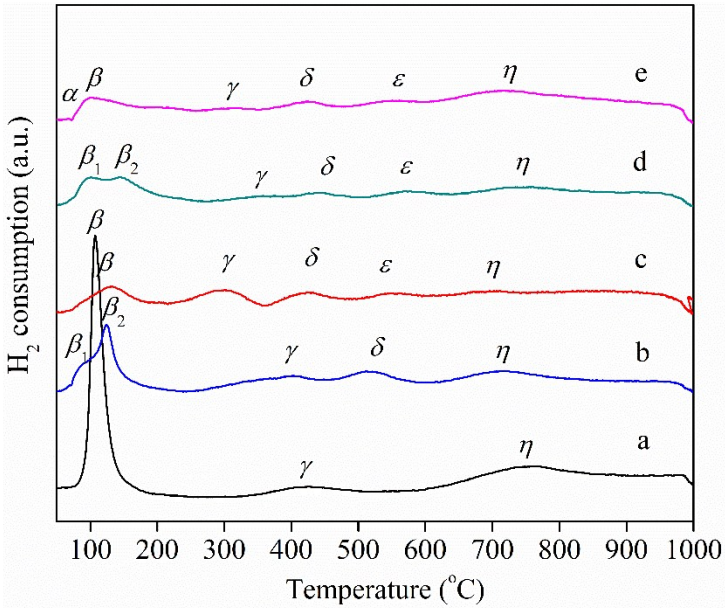

Fig.S5 H_2-TPR profiles of the PdM/CeO_2-ND catalysts: (a) Pd/CeO_2-ND, (b) PdMg/CeO_2-ND, (c) PdCa/CeO_2-ND, (d) PdSr/CeO_2-ND and (e) PdBa/CeO_2-ND

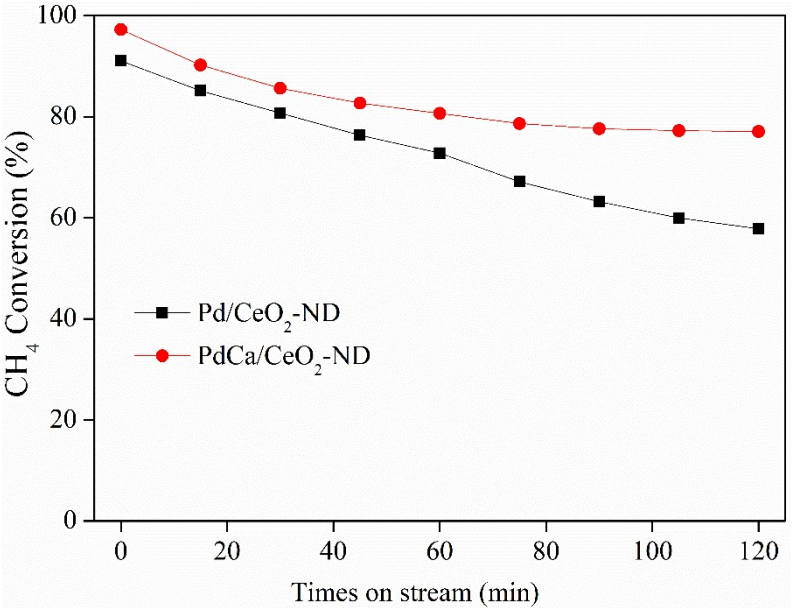

Fig.S6 Long-term stability of PdCa/CeO_2-ND and Pd/CeO_2-ND catalysts at 450°C for 120 min. GHSV: 16,000 mL $g^{-1}h^{-1}$.

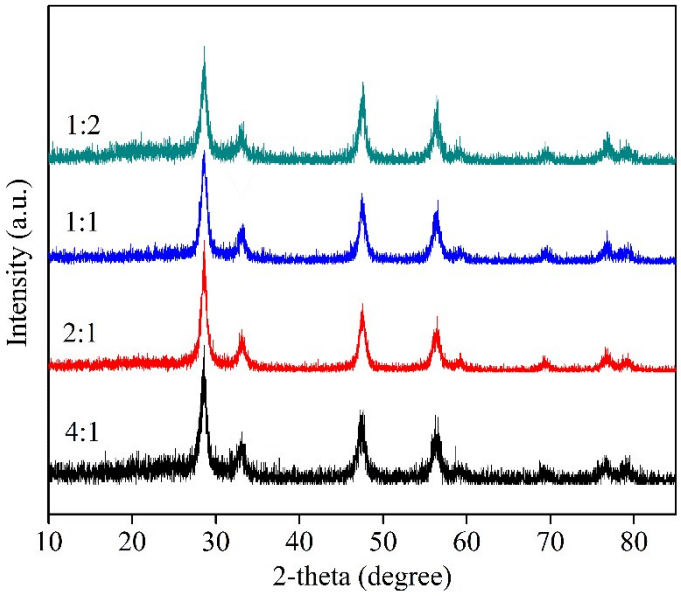

Fig.S7 XRD patterns over the $PaCa/CeO_2$-ND catalysts with different molar ratio of Pd/Ca

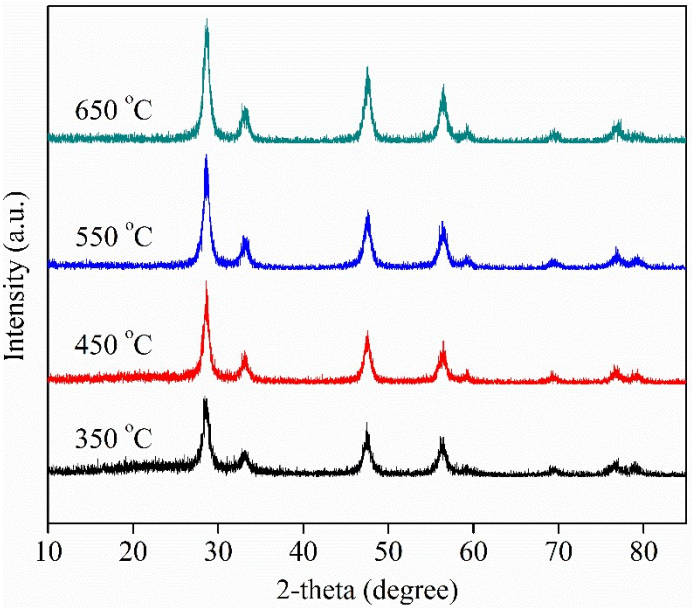

Fig.S8 XRD patterns over the $PaCa/CeO_2$-ND catalysts (n(Pd):n(Ca) = 2:1) with different calcination temperatures

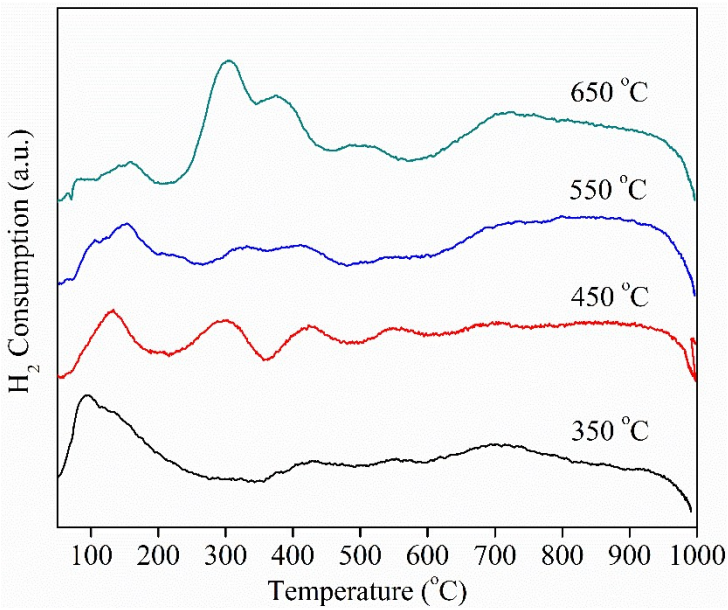

Fig.S9 H_2-TPR profiles over the $PaCa/CeO_2$-ND catalysts (n(Pd):n(Ca) = 2:1) with different calcination temperatures