

## **Supplementary Information**

### **Enhanced H<sub>2</sub> production from Ethanolysis of Sodium borohydride over ternary Co<sub>0.97</sub>Pt<sub>0.03</sub>/CeO<sub>x</sub> nanocomposite grown on catalytic support CGO**

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**KEYWORDS:** Ethanolysis; CGO; Sodium borohydride; Ammonia borane; hydrogen production; Activation Energy.

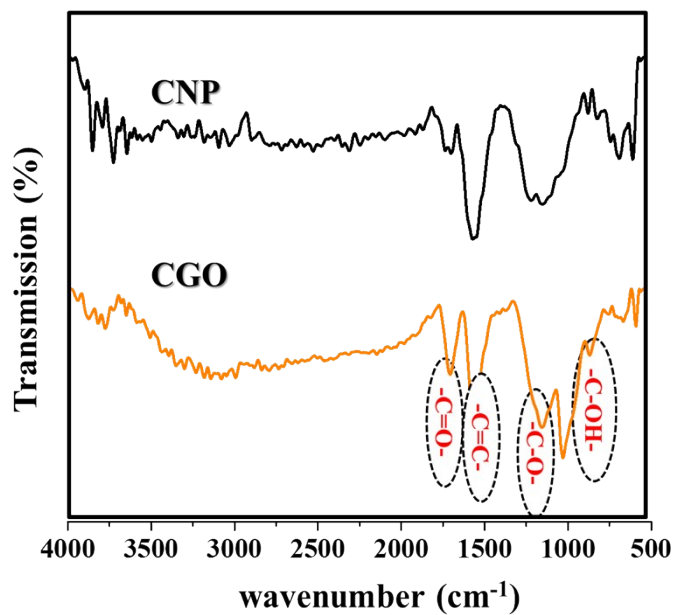
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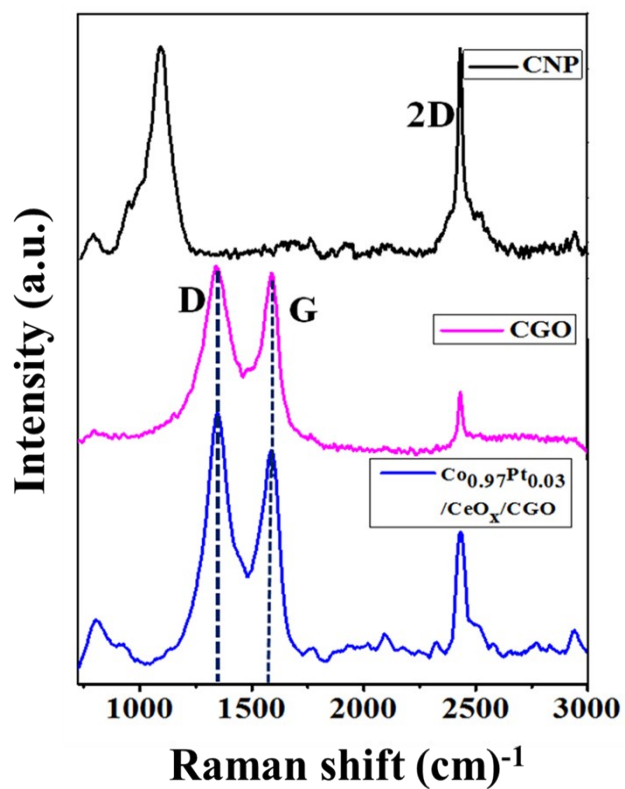
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- Figure.S13** Reusability of  $\text{Co}_{0.97}\text{Pt}_{0.03}/\text{CeO}_x/\text{CGO}$  nanohybrid for alkaline ethanolysis of SB.

**Table.S1** Summary of deconvolution analysis of CGO.

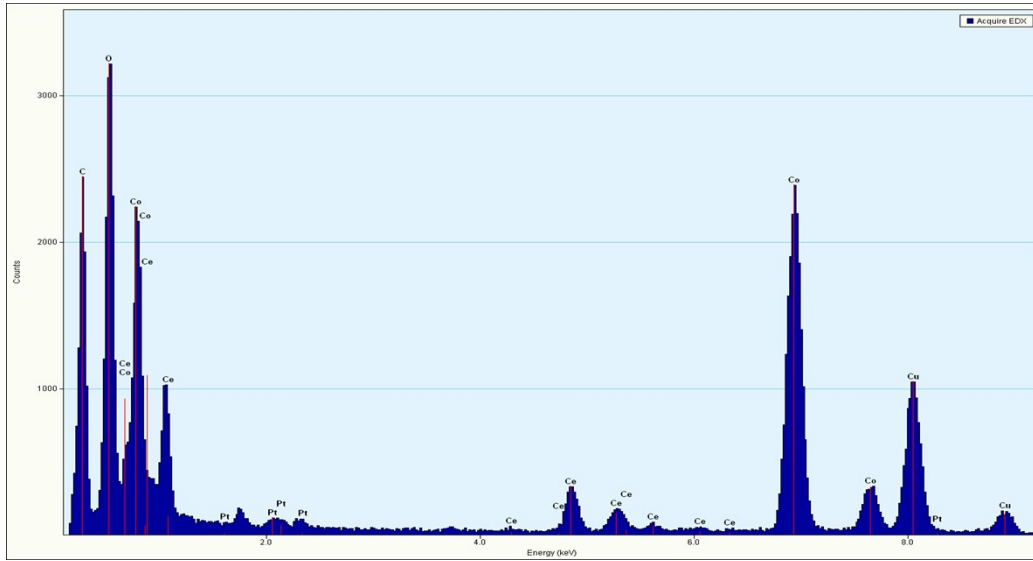
**Table.S2** Summary of deconvolution analysis of  $\text{Co}_{0.97}\text{Pt}_{0.03}/\text{CeO}_x/\text{CGO}$ .



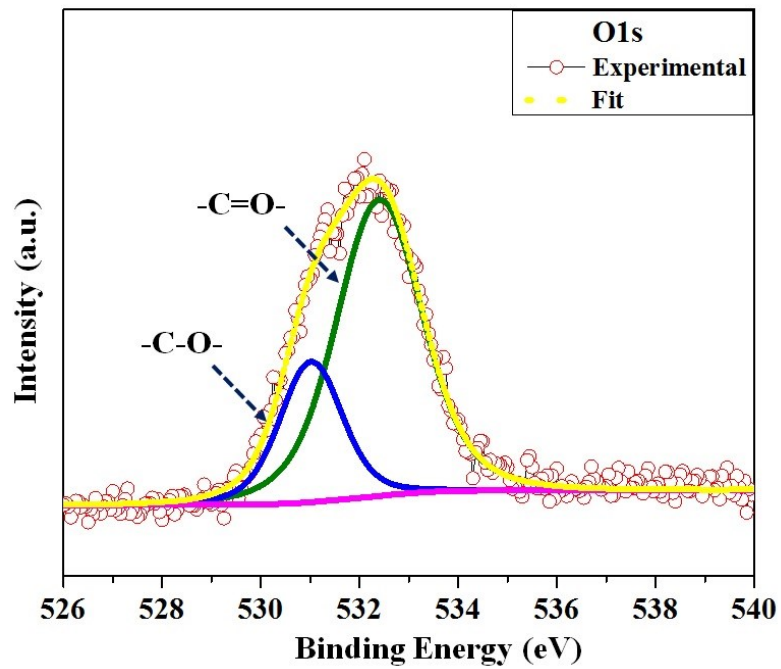
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**Figure. S4.** The High resolution O1s XPS spectrum of CGO.

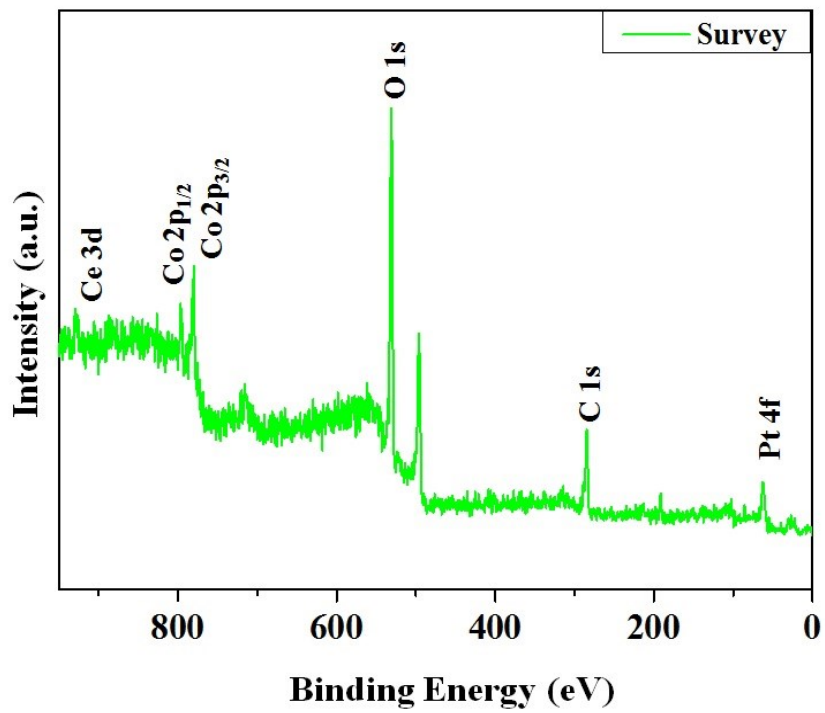
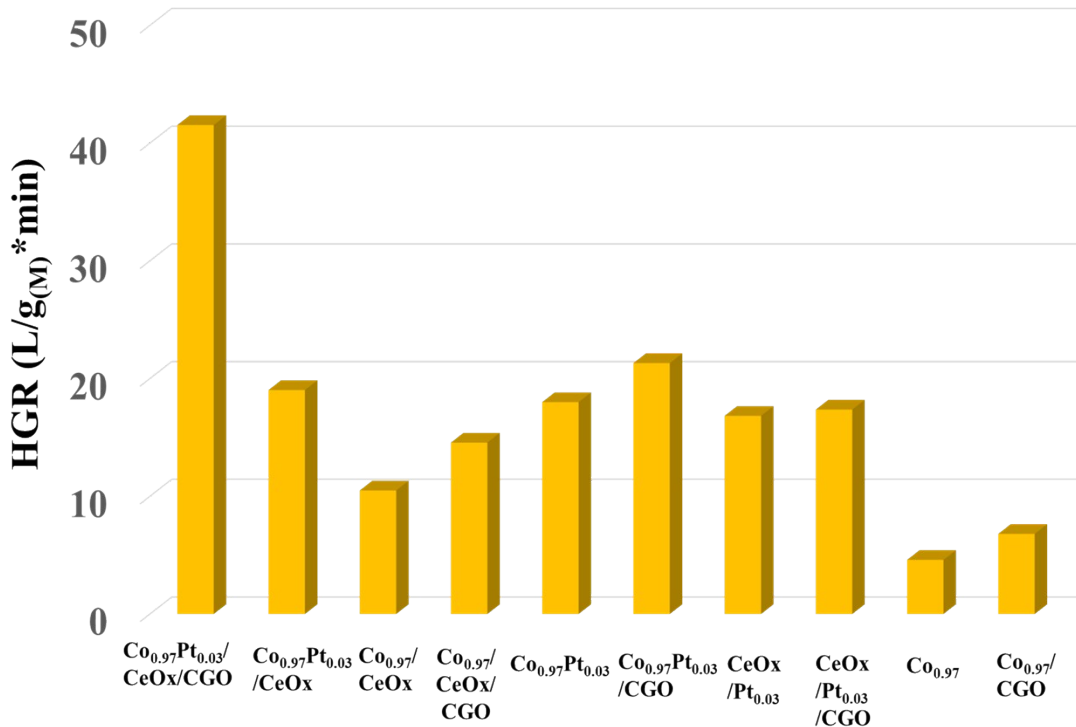
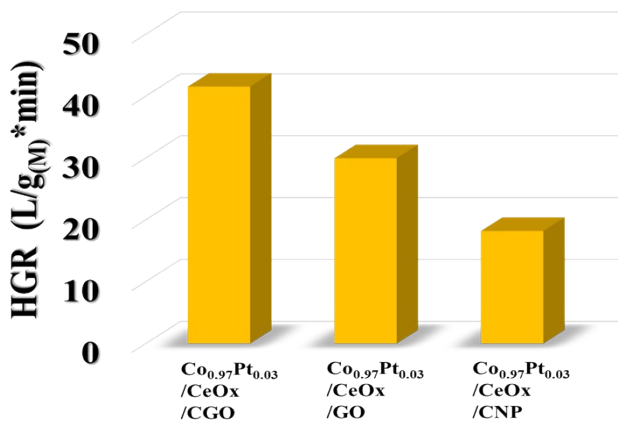


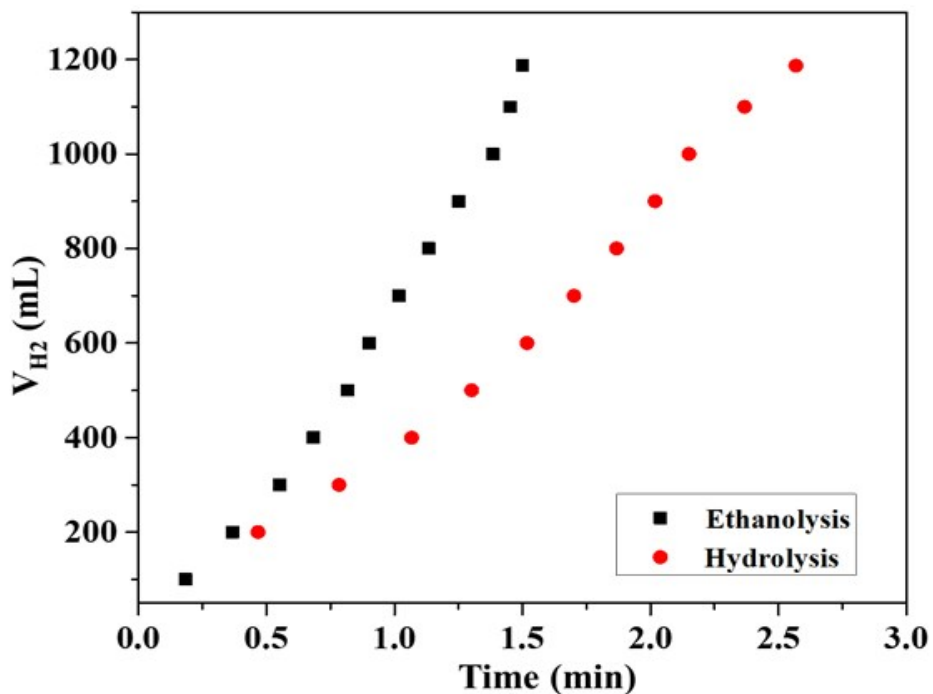
Figure. S5. XPS Survey spectrum of  $\text{Co}_{0.97}\text{Pt}_{0.03}/\text{CeOx}/\text{CGO}$ .



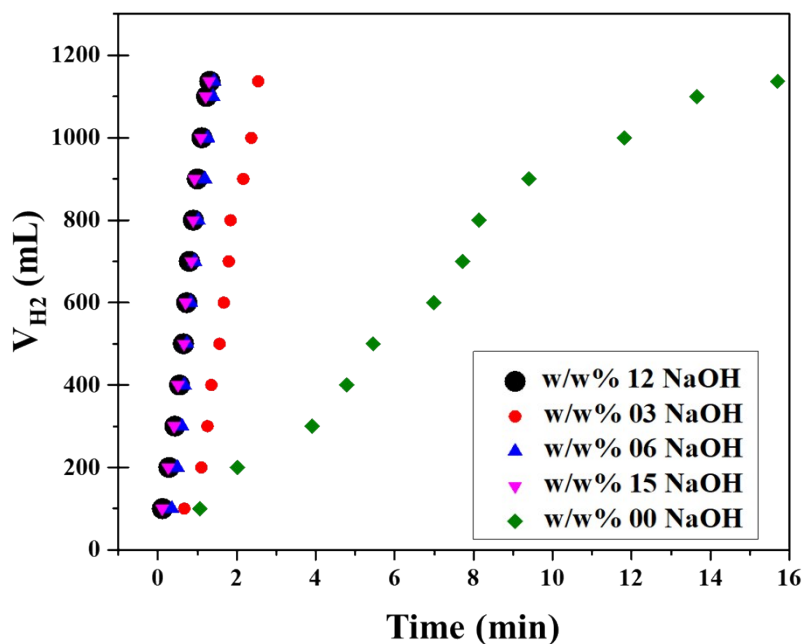
**Figure. S6.** Rate of H<sub>2</sub> generation (HGR) (L/g<sub>(M)</sub>\*min) from ethanolsis of SB catalyzed by nanohybrid with support (Co<sub>0.97</sub>Pt<sub>0.03</sub>/CeOx/CGO; Co/CeOx/CGO; Co<sub>0.97</sub>Pt<sub>0.03</sub>/CGO; CeOx/Pt<sub>0.03</sub>/CGO; Co/CGO) and without support (Co<sub>0.97</sub>Pt<sub>0.03</sub>/CeOx; Co/CeOx; Co<sub>0.97</sub>Pt<sub>0.03</sub>; CeOx/Pt<sub>0.03</sub>; Co).



**Figure. S7.** Effect of catalytic support (S: CNP, GO and CGO) on rate of hydrogen production from alkaline ethanolsis of SB catalyzed by Co<sub>0.97</sub>Pt<sub>0.03</sub>/CeOx/S nanohybrid.

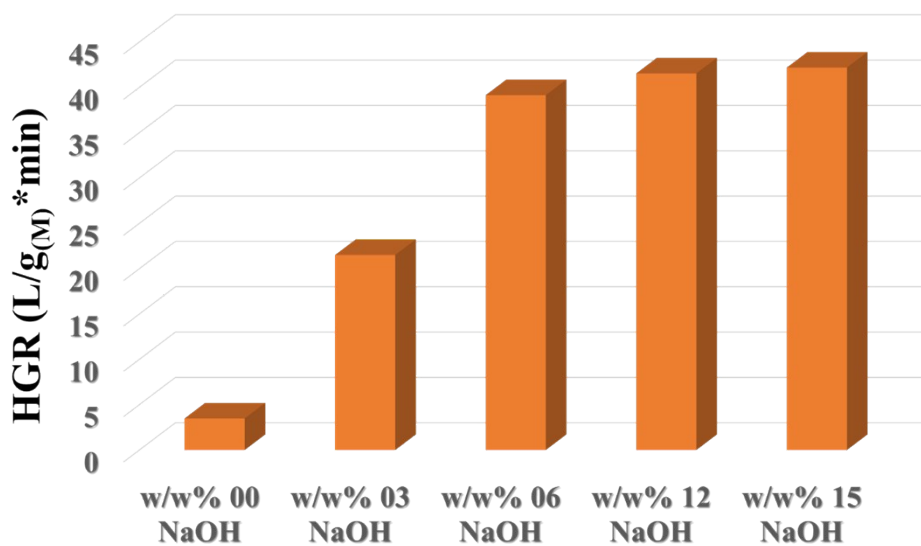


**Figure. S8.** Effect of solvotic medium on rate of hydrogen production from alkaline ethanolysis of SB catalyzed by  $\text{Co}_{0.97}\text{Pt}_{0.03}/\text{CeO}_x/\text{CGO}$  nanohybrid.

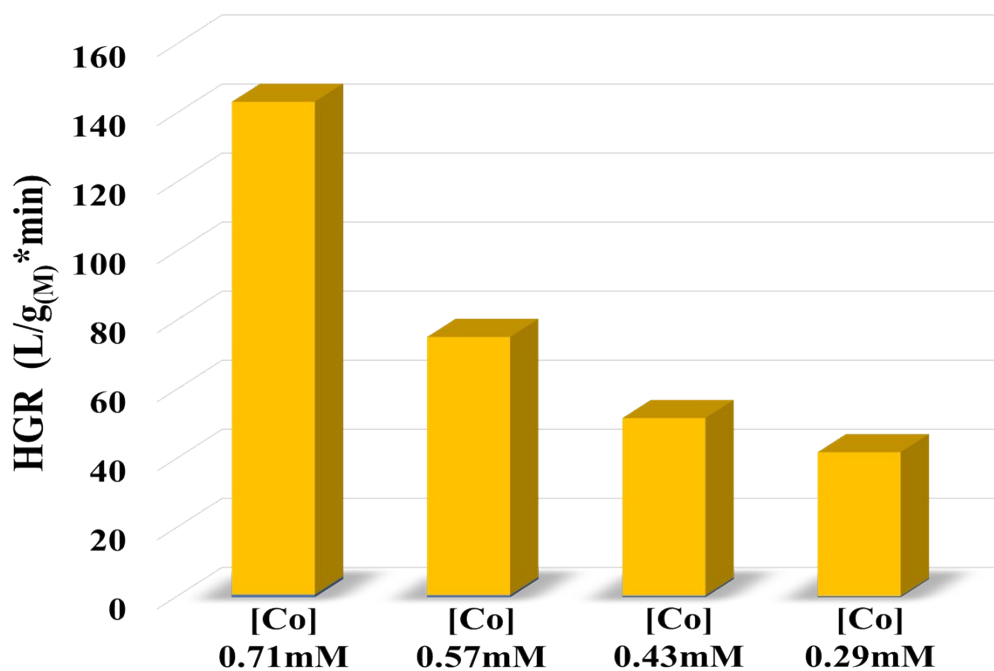


**Figure.S9.** Plot of the volume of  $\text{H}_2$  generated versus time (min) for ethanolysis of SB (13.21 mM) catalyzed by  $\text{Co}_{0.97}\text{Pt}_{0.03}/\text{CeO}_x/\text{CGO}$  at 300 K for different concentration of NaOH.

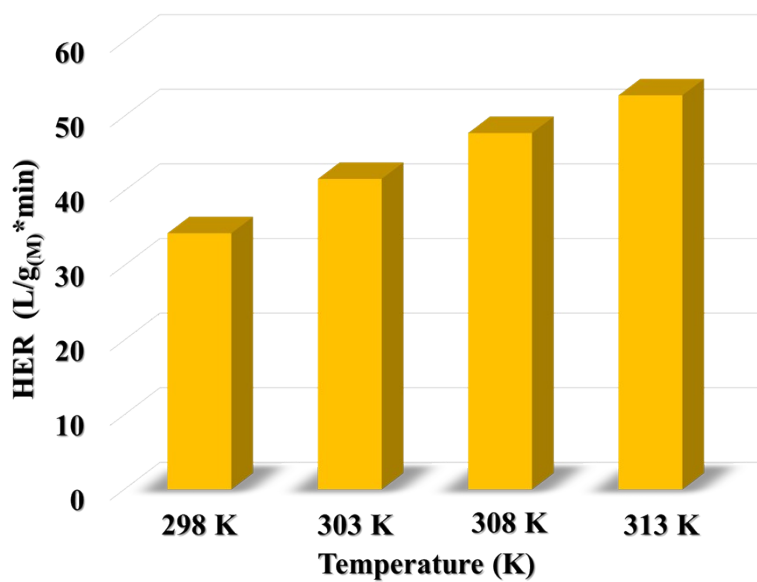




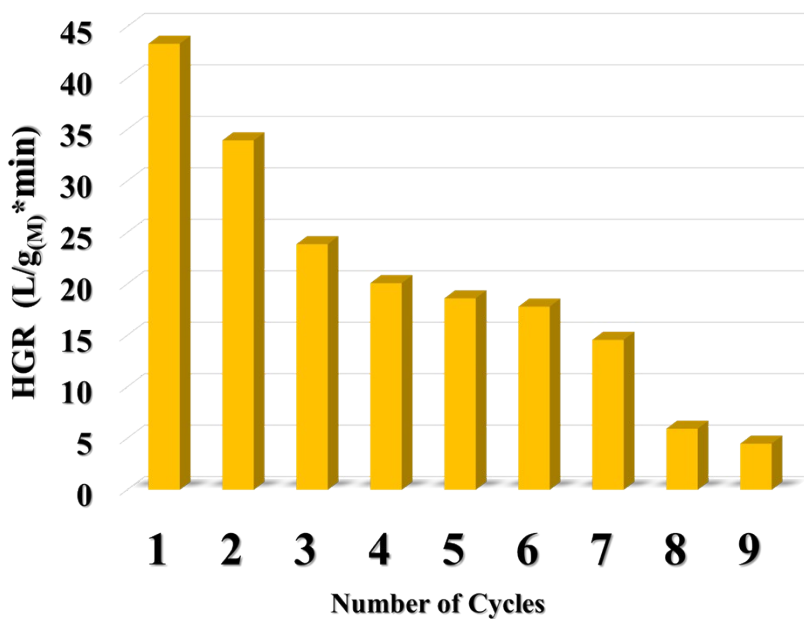
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**Figure. S11.** Effect of Co-concentration on rate of hydrogen production from alkaline ethanolsis of SB catalyzed by Co<sub>0.97</sub>Pt<sub>0.03</sub>/CeO<sub>x</sub>/CGO nanohybrid.



**Figure. S12.** Effect of temperature on rate of hydrogen production from alkaline ethanolysis of SB catalyzed by  $\text{Co}_{0.97}\text{Pt}_{0.03}/\text{CeO}_x/\text{CGO}$  nanohybrid.



**Figure. S13.** Reusability of  $\text{Co}_{0.97}\text{Pt}_{0.03}/\text{CeO}_x/\text{CGO}$  nanohybrid for alkaline ethanolysis of SB.

**Table.S1:** Summary of deconvolution analysis of CGO.

Catalyst	Functional Group	Binding Energy (eV)	% Total <sup>a</sup>
CGO	Csp2	283.96	55.9
	Csp3	285.4	11.8
	C-O	285.8	8.4
	O-C-O	286.4	10.2
	C=O	288.28	7.8
	O-C=O	289.06	5.9

a = % Total calculated by comparing peak area under the curve

**Table. S2:** Summary of deconvolution analysis of Co<sub>0.97</sub>Pt<sub>0.03</sub>/CeO<sub>x</sub>/CGO.

Catalyst	Valance state	Binding energy (eV)	% Total <sup>a</sup>
Co-Pt-CeO <sub>x</sub> /CGO	Co (0)	778.08	25.5
	Co (II)	780.13	27.1
	Co (III)	795.2	47.4
	Ce (III)	903.48 (u')	21
		885.26 (v')	
	Ce (IV)	901.39 (u)	79
		907.09 (u'')	
		916.93 (u''')	
		882.84 (v)	
		888.11 (v'')	
		898.24 (v''')	
	Pt (0)	71.72	80.3
		74.97	
	Pt (II)	72.42	19.7
75.89			

a = % Total calculated by comparing peak area under the curve