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Supporting Information

for

1-D Coordination Polymer Route to Catalytically Active Co@C Nanoparticles

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Table of Content:

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Table S1: Selected bond lengths and angles from compound **1**

Co(1)-O(3)	2.007(2)	Co(1)-N(3)	2.029(2)
Co(1)-O(1)	2.0083(18)	Co(1)-N(1)	2.056(2)
O(3)-Co(1)-O(1)	99.98(9)	O(3)-Co(1)-O(1)	99.98(9)
O(3)-Co(1)-N(3)	128.46(10)	O(3)-Co(1)-N(3)	128.46(10)
O(1)-Co(1)-N(3)	117.77(8)	O(1)-Co(1)-N(3)	117.77(8)

Table S2. Non-covalent CH… π Interaction in 1-D Co-Polymeric complex **1**.

CH… π Interaction in **1**			
X-H…Cg(J)	d(H….Cg) Å	γ-angle (^{o})	Symmetry code
C(7)-H(7A)…Cg(3)	2.93	9.24	[1655.01]
C(3) -H(3A)…Cg(4)	2.84	5.01	[1655.01]
C(9)-H(9A)…Cg(5)	2.93	18.53	[1455.01]
Cg(J) = center of gravity of ring J; γ-angle = angle between Cg-H vector and ring J normal. Centroid: Cg(3) =N(1)-C(9)-N(2)-C(10)-C(11), Cg(4) = N(3)-C(13)-N(4)-C(14)-C(15), Cg(5) = C(2)-C(3)-C(4)b-C(2)b-C(3)b-C(4). [1455] = -1+x,y,x; [1655] = 1+x,y,z.			

Table S3. Non-covalent H-bonding interaction in 1-D Co-Polymeric complex **1**.

H-bonding Interaction in **1**			
D-H…A	d(H…A) Å	D-H…A angle (^{o})	Symmetry code
C(10)-H(10A)..O(2)	2.56	167	[1465.01]
C(12)-H(12C)..O(1)	2.55	160	[2665.01]
D-H…A= Donor-Hydrogen…Acceptor; [1465] =1-x,1-y,-z; [2665] =- 1+x,1+y,z.			

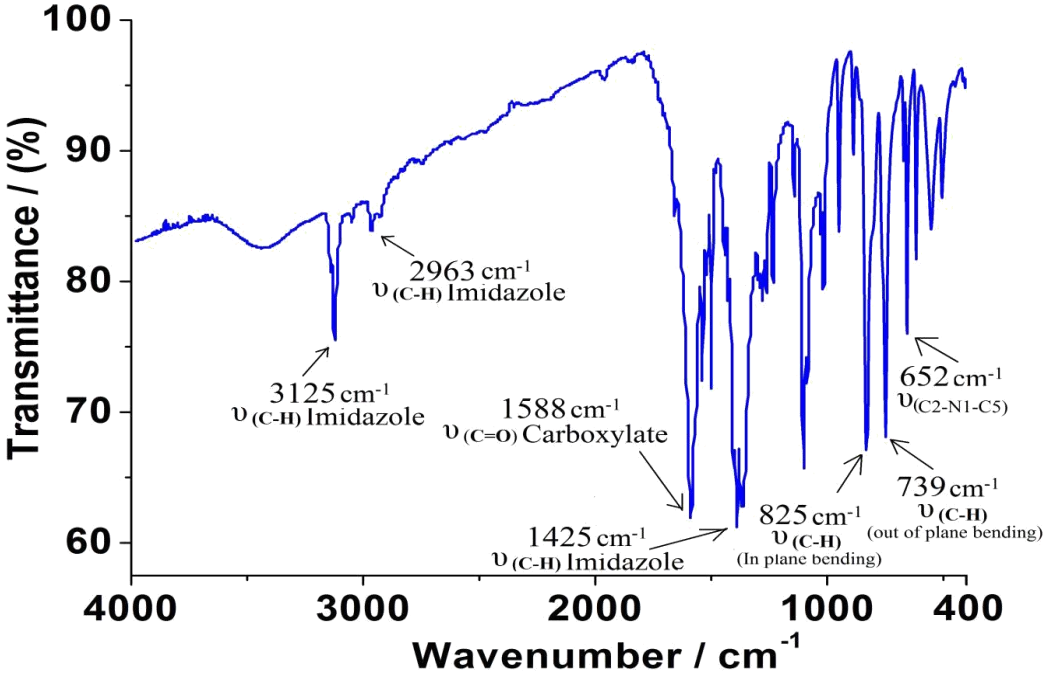

Fig S1: FT-IR spectrum of **1** in KBr disc.

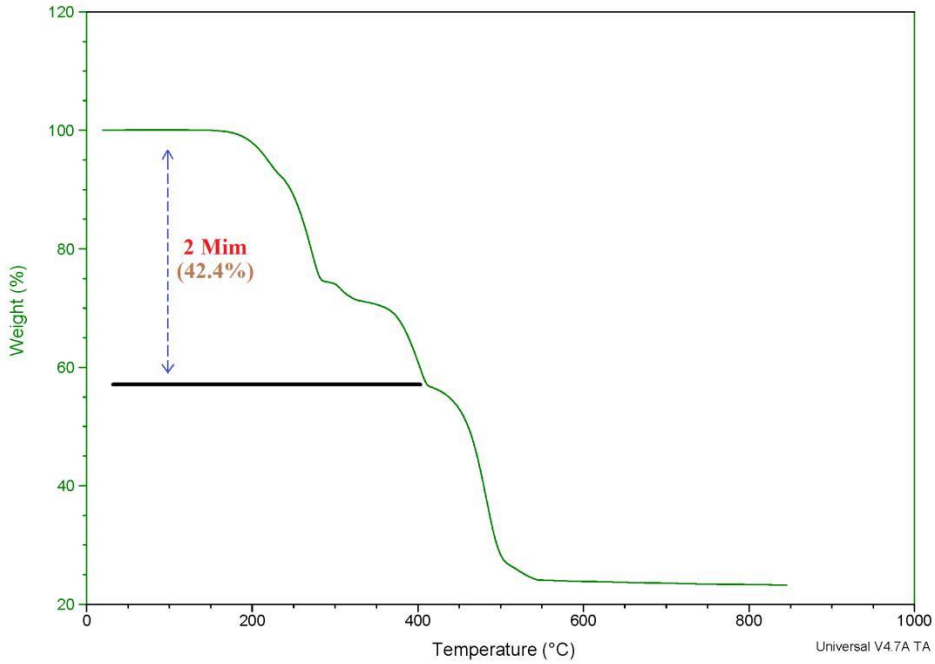

Fig. S2: TGA profile of as synthesized **1** under N_2 flow (40 mL/min).

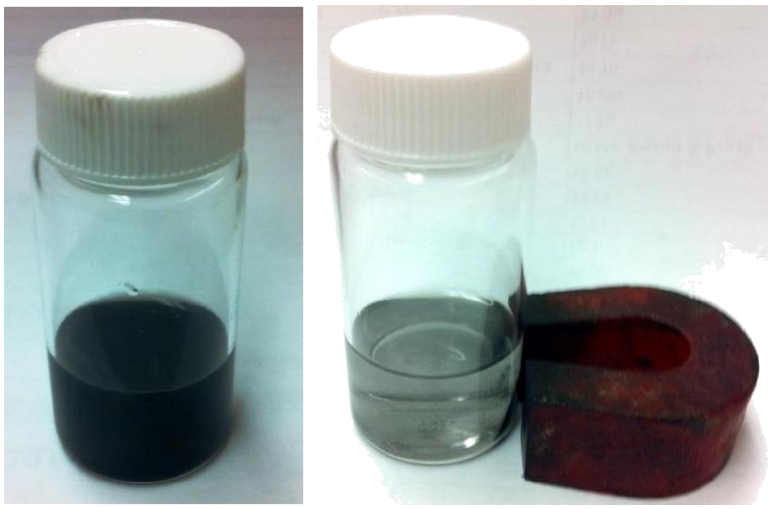

Fig. S3: Physical separation of a suspension of **2** in ethanol with a horse shoe magnet.

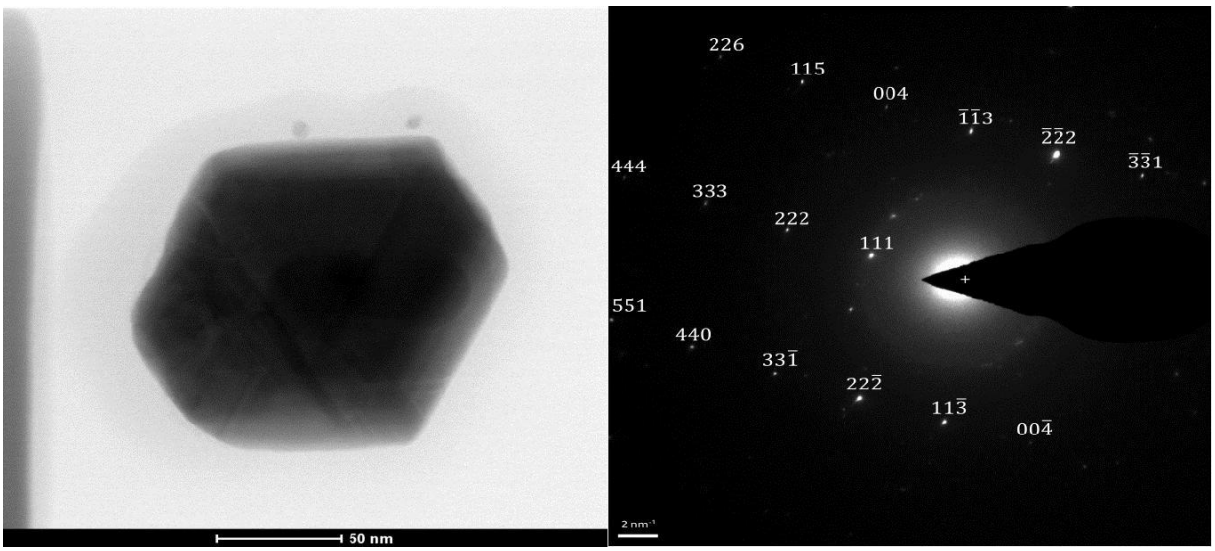

Fig. S4: STEM image of a single Co nanoparticle (left) and its electron diffraction pattern indexed to cubic cobalt; viewed along [111] zone axis (right).

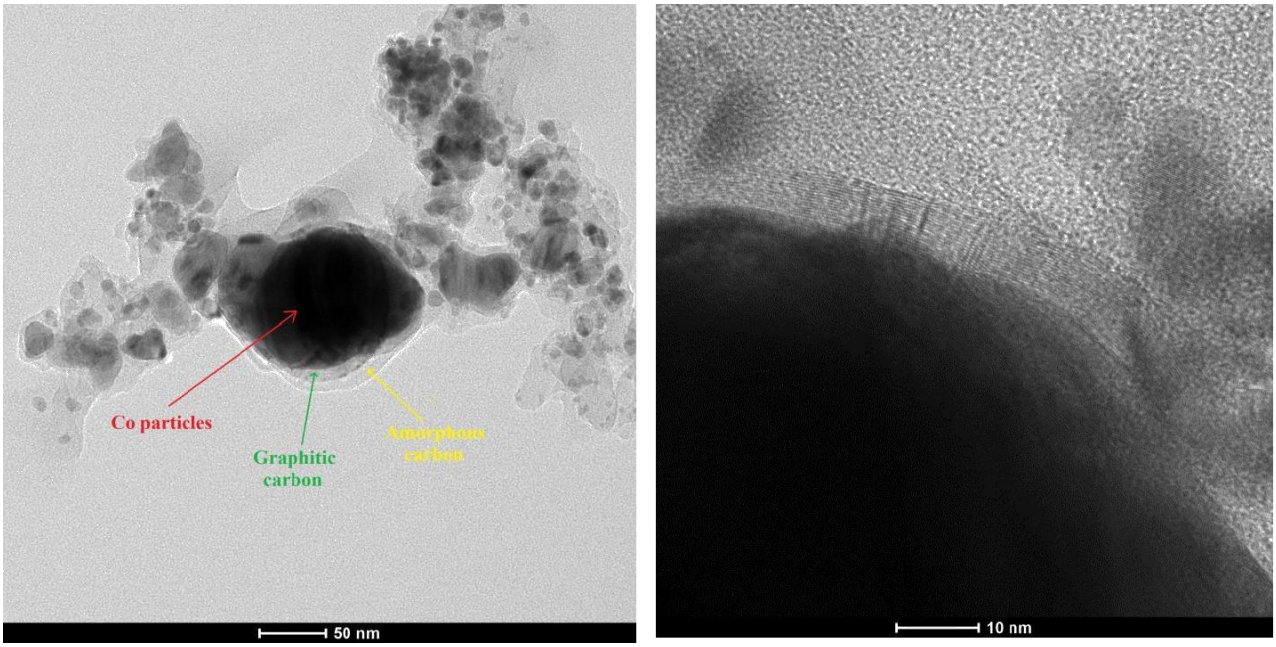

Fig. S5: TEM image of as synthesized **2** showing different region for Co particles embedded by graphitic and amorphous carbon (left) and TEM micrographs for lattice fringes along the boundary region showing the presence of graphitic carbon shell over cobalt particles.

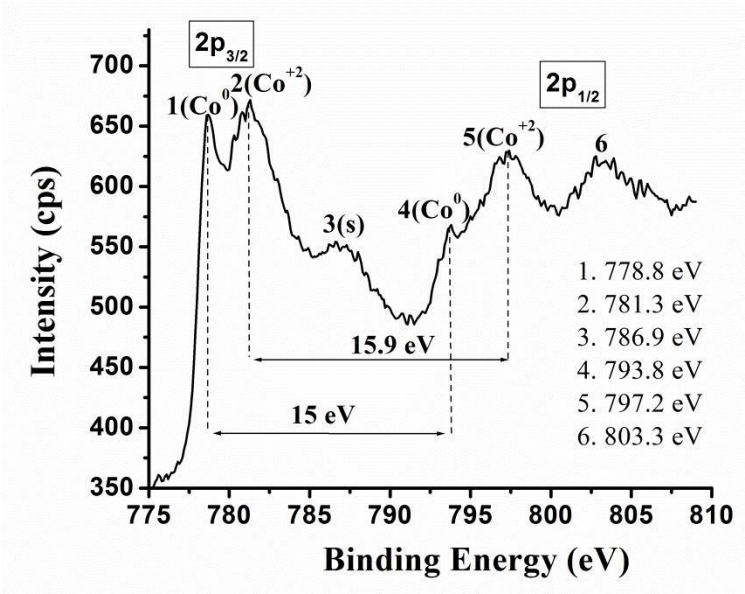

Fig. S6. Cobalt 2p XPS spectrum of 2 without Ar sputtering. Peaks assigned are listed numerically in the inset. Metallic cobalt (Co^{0}), divalent cobalt (Co^{+2}), and Co^{+2} shake-up satellites (s) are labelled.[1] Co^{+2} peaks are noted to have formed from slow oxidation of reactive metallic cobalt with oxygen.[2]

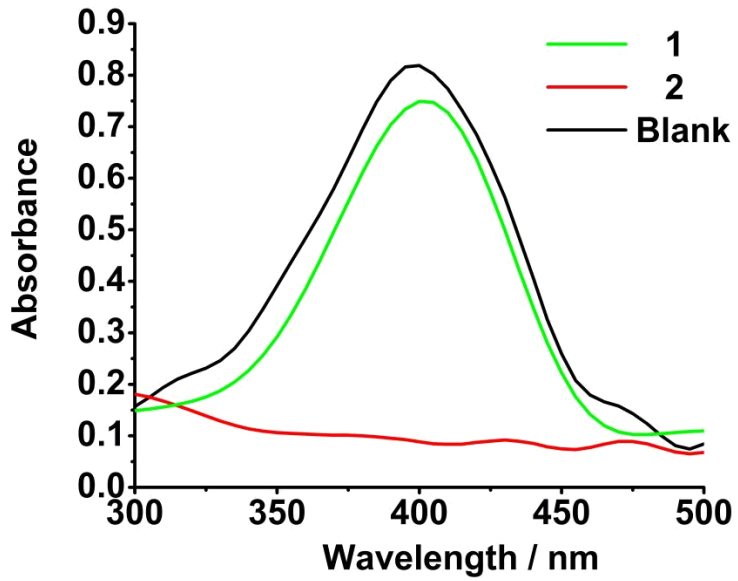

Fig. S7: Reduction of PNP to PAP with **1** (green line), **2** (red line) and in absence of any catalyst (black line).

Table S4: Comparison of rate constants for support and supported catalyst.

Entry	Catalyst	S_{BET} ($m^2 g^{-1}$)	K_{app} (min^{-1})	References
1.	Carbon nanotube (CNT)	176.7	0.001	Gu et. al. Nanoscale, 2014, 6, 6609. [3]
2.	Carbon sphere	13	0.0	Tang et. al. J. Mater. Chem., 2010, 20, 5436. [4]
3	RGO (metal free)	-	0.0	Nie et. al. Carbon, 2012, 50, 586. [5]
2	Pd-NP/CNT	220.5	0.632	Gu et. al. Nanoscale, 2014, 6, 6609. [3]
3	Au/C	770	0.60	Guo et. al. Chem. Commun., 2012, 48, 11094. [6]
4	Au@SiO_2	nd*	0.234	Lee et. al. Adv. Mater., 2008, 20, 1523. [7]
5	Co@SiO_2	20.2	0.815	Yan et. al. Inorg. Chem. 2014, 53, 9073. [8]
6	Co@C	128	0.34	This work

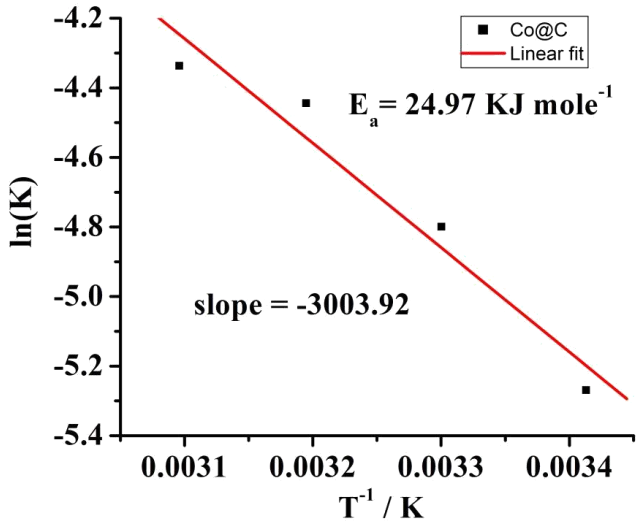

Fig. S8: Reduction of PNP to PAP with **2** (red line) and in absence of any catalyst (black square).

Table S5: Comparison of activation energy among metal supported nanoparticles.

Sl No.	Catalyst (carrier)	C_{PNP} [M]	C_{BH4} [M]	E_a [KJ mole^{-1}]	References***
1	AgNP	6.0×10^{-5}	2.5×10^{-3}	41.0	Pradhan et. al [9]
2	AuNP (PMMA beads)	4.9×10^{-5}	7.2×10^{-2}	38.0	Kuroda et. al [10]
3	AuNP (Ca-alignate stabilized)	1.0×10^{-4}	1.0×10^{-1}	20.5	Saha et. al [11]
4	Pt-cubes (colloidal)	1.9×10^{-5}	3.2×10^{-2}	12.0	Mahmoud et. al [12]
5	Pd NP (Al_2O_3)	1.0×10^{-4}	1.3×10^{-2}	43.0	Arora et. al [13]
6	Ni NP (hydrogel network)	1.4×10^{-2}	2.9×10^{-1}	25.7	Sahiner at. al [14]
7	Co NP (hydrogel network)	1.4×10^{-2}	2.9×10^{-1}	27.8	Sahiner at. al [15]
8	Co@C	3.7×10^{-5}	3.7×10^{-2}	24.9	This work

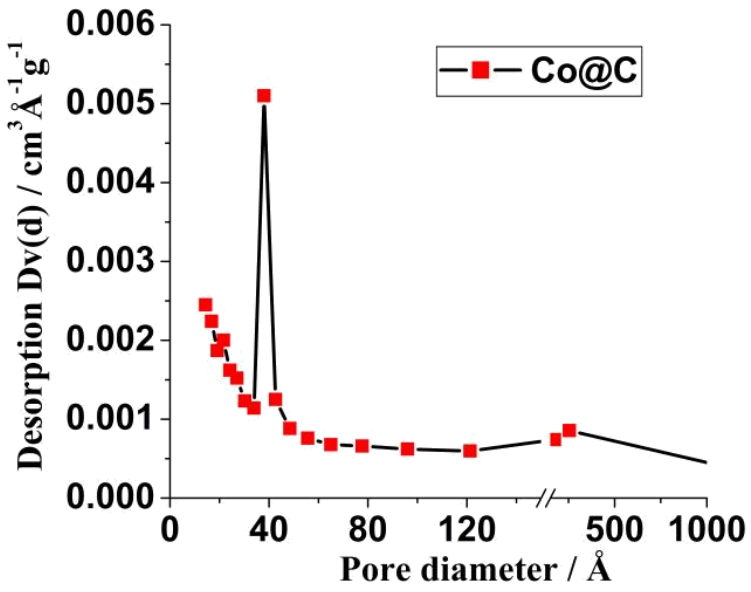

Fig S9: Pore diameter distribution of **Co@C (2)** calculated using BJH method.

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