Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information:

Cerium oxide based active catalyst for Hydroxylammonium Nitrate (HAN) fueled monopropellant thrusters

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Constant Volume batch reactor: It essentially consists of a small enclosed chamber wherein the pressure and temperature rise arising from the decomposition of the monopropellant when injected onto a catalyst bed can be monitored as a function of time.

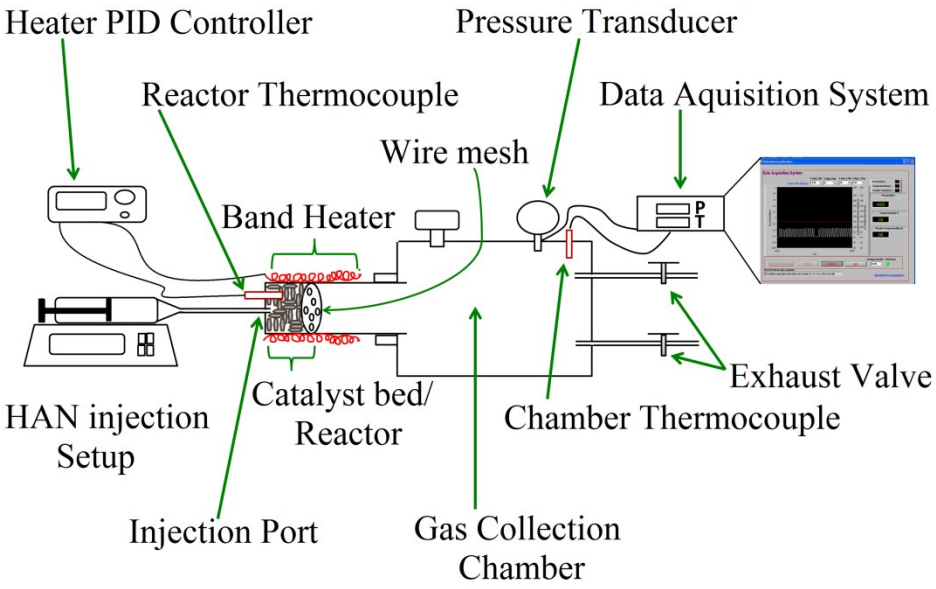

Fig. S1 Schematic of the Batch reactor.

Batch reactor studies on CeCo 26-HAN: The pressure–time curves obtained for CeCo 26 shows that the cerium based catalyst retained its activity for the 50 injections without any loss of pressure.

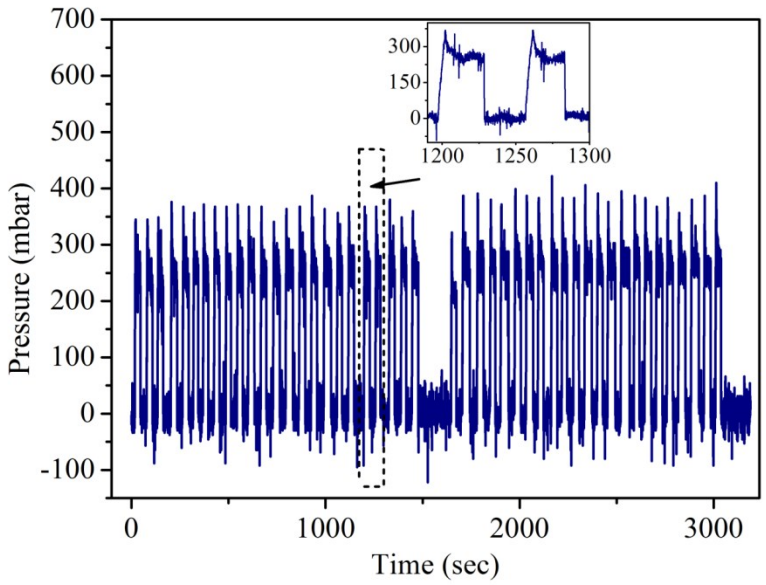

Fig. S2 Pressure-Time curve in a batch reactor for a HAN-(CeCo 26) catalyst system for 50 injections.

XRD:

Table S1 Effect of dopant on ceria phase distribution, crystallite size (D), inter-planar spacing (d-spacing), and cell parameter (a).

Samples	Phases	Peak	2θ (degrees)	D (nm)	d-spacing (Å)	a (Å)
Pure CeO_2		111	28.49	45.6	3.129	5.420
CeCo 2	CeO_2	111	28.50	50.1	3.128	5.417
CeCo 15	CeO_2	111	28.38	52.9	3.141	5.440
	Co_3O_4	311	36.69	-	-	-
CeCo 20	CeO_2	111	28.49	51.6	3.129	5.419
	Co_3O_4	311	36.79	-	-	-
CeCo 26	CeO_2	111	28.50	51.0	3.128	5.418
	Co_3O_4	311	36.80	-	-	-
CeCo 26x	CeO_2	111	28.48	48.8	3.130	5.421
	Co_3O_4	311	36.79	-	-	-
CeCo 28	CeO_2	111	28.51	47.3	3.127	5.416
	Co_3O_4	311	36.80	-	-	-

Table S2 Comparison of Thermally aged CeCo 26 with pristine CeCo 26 using crystallite parameters.

Samples	Phases	Peak	2θ (degrees)	D(nm)	d-spacing (Å)	a (Å)
CeCo 26	CeO_2	111	28.49977	50.985	3.128	5.418
	Co_3O_4	311	36.79967	-	-	-

CeCo 26 after annealing at 1400^{o}C for 2 hrs	CeO_2	111	28.51332	59.27	3.127	5.415
	Co_3O_4	311	36.78585	-	-	-
	CoO	200	42.62612	-	-	-

XPS: The Co content of the samples could be obtained by XPS but in this paper the values of area obtained by Co 2p are highly unreliable as noise to signal ratio is fairly high (Fig. 4c) which has been pointed out in XPS studies. The values obtained via XPS for Co:Ce ratio are given below in Table;

Table S3 Co:Ce ratio derived from XPS data

Sample	Co : Ce ratio
CeCo 20	6 : 94
CeCo 26	7 : 93
CeCo 26x	5.5 : 94.5
CeCo 28	13:87
CeCo 26_annealed at 1400°C	8:92

Though absolute values of cobalt content are different in both XPS and EDS studies, there appears to be a relation. The values obtained in XPS are 2-2.5times smaller than the value estimated from EDS studies (Table 3), probably due to different means of technique.