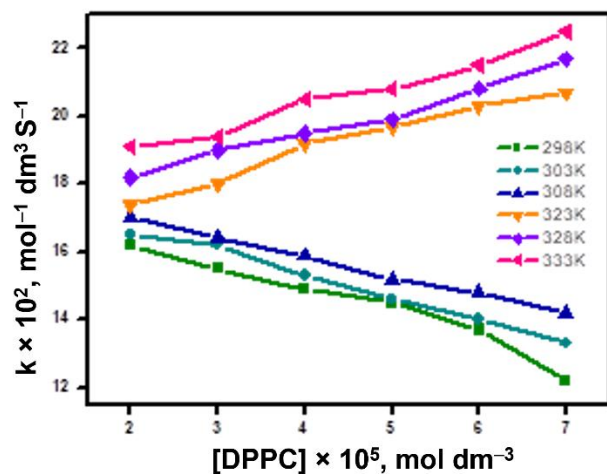
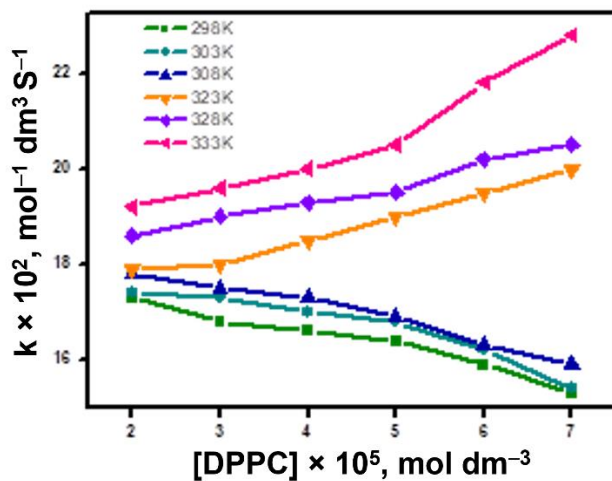


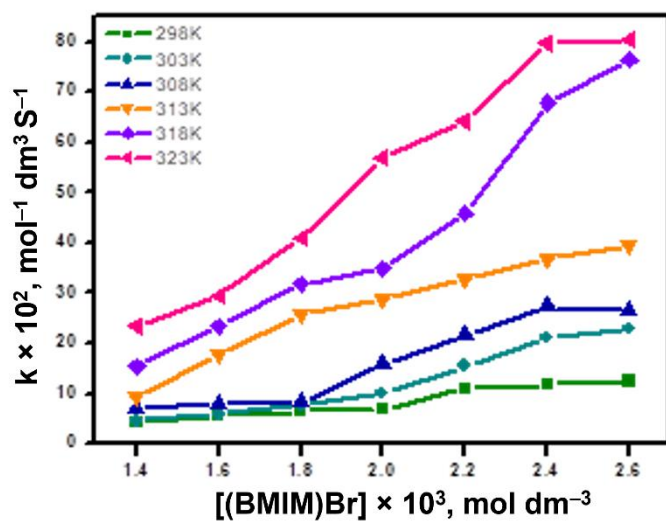
## Supplementary Information



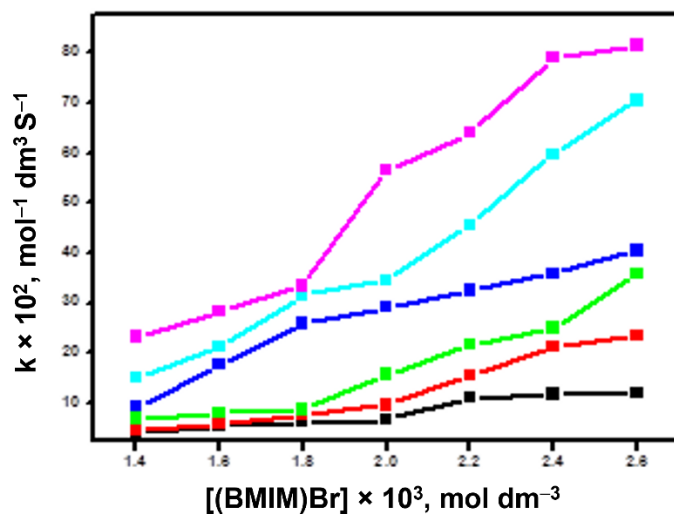
SI Figure S1 Plot of  $k$  against DPPC for  $\text{Cis-}[\text{Co}(\text{dpq})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3$  under various temperatures;  $\text{cis-}[\text{Co}(\text{ip})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3 = 4 \times 10^{-4} \text{ mol dm}^{-3}$ ,  $\mu = 1.0 \text{ mol dm}^{-3}$ ,  $[\text{Fe}(\text{CN})_6]^{4-} = 0.01 \text{ mol dm}^{-3}$



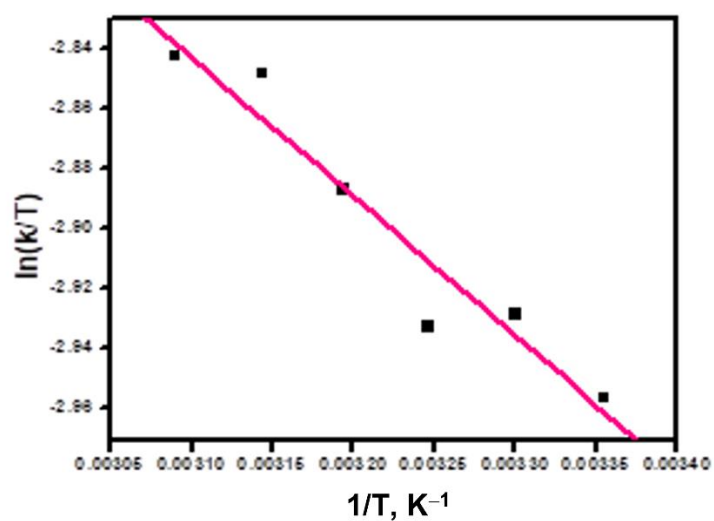
SI Figure S2 Plot of  $k$  against DPPC for  $\text{Cis-}[\text{Co}(\text{dpqc})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3$  under various temperatures;  $\text{cis-}[\text{Co}(\text{ip})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3 = 4 \times 10^{-4} \text{ mol dm}^{-3}$ ,  $\mu = 1.0 \text{ mol dm}^{-3}$ ,  $[\text{Fe}(\text{CN})_6]^{4-} = 0.01 \text{ mol dm}^{-3}$



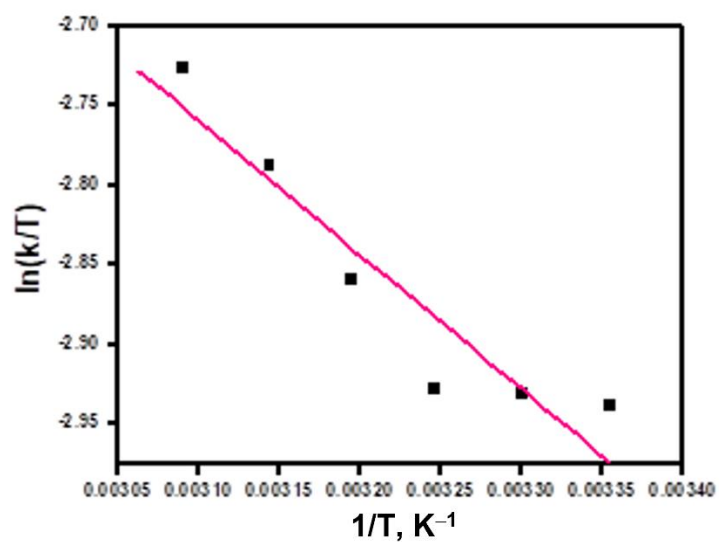
SI Figure S3 Plot of  $k$  against  $[\text{BMIM}]\text{Br}$  for  $\text{Cis-}[\text{Co}(\text{dpq})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3$  at various temperatures;  $\text{Cis-}[\text{Co}(\text{ip})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3 = 4 \times 10^{-4} \text{ mol dm}^{-3}$ ,  $\mu = 1.0 \text{ mol dm}^{-3}$ ,  $[\text{Fe}(\text{CN})_6]^{4-} = 0.01 \text{ mol dm}^{-3}$



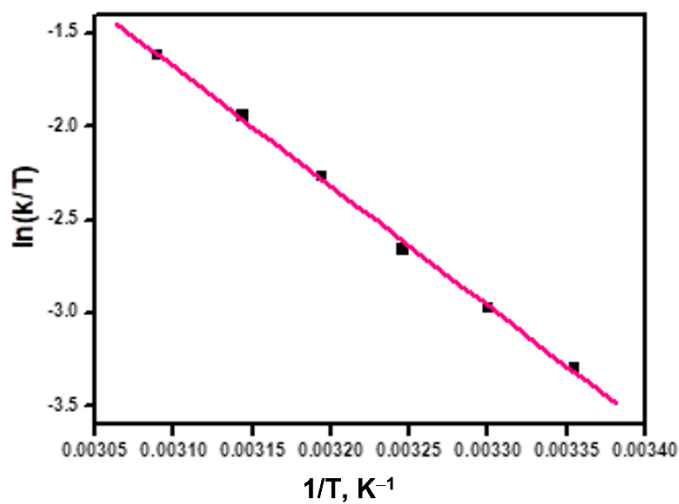
SI Figure S4 Plot of  $k$  against  $[\text{BMIM}]\text{Br}$  for  $\text{Cis-}[\text{Co}(\text{dpqc})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3$  at various temperatures;  $\text{Cis-}[\text{Co}(\text{ip})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3 = 4 \times 10^{-4} \text{ mol dm}^{-3}$ ,  $\mu = 1.0 \text{ mol dm}^{-3}$ ,  $[\text{Fe}(\text{CN})_6]^{4-} = 0.01 \text{ mol dm}^{-3}$



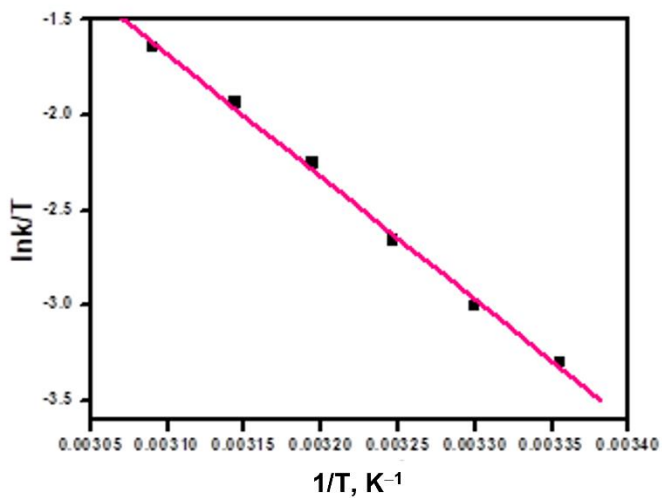
SI Figure S5 Eyring plot for Cis-[Co(dpq)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> in DPPC medium. [complex] = 4 × 10<sup>-4</sup> mol dm<sup>-3</sup>; [Fe(CN)<sub>6</sub>]<sup>4-</sup> = 0.01 mol dm<sup>-3</sup>; [μ] = 1.0 mol dm<sup>-3</sup>.



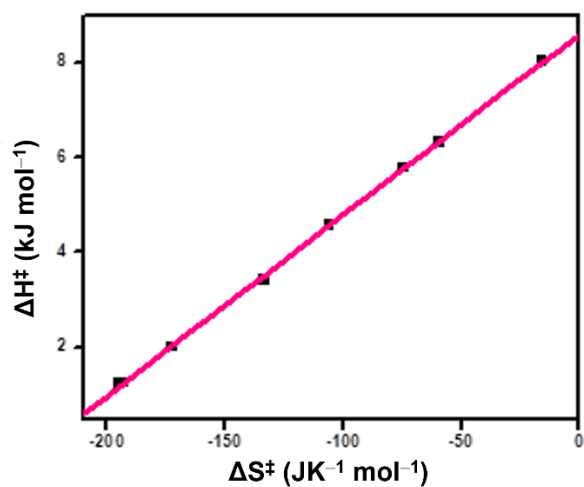
SI Figure S6 Eyring plot for Cis-[Co(dpqc)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> in DPPC medium. [complex] = 4 × 10<sup>-4</sup> mol dm<sup>-3</sup>; [Fe(CN)<sub>6</sub>]<sup>4-</sup> = 0.01 mol dm<sup>-3</sup>; [μ] = 1.0 mol dm<sup>-3</sup>.



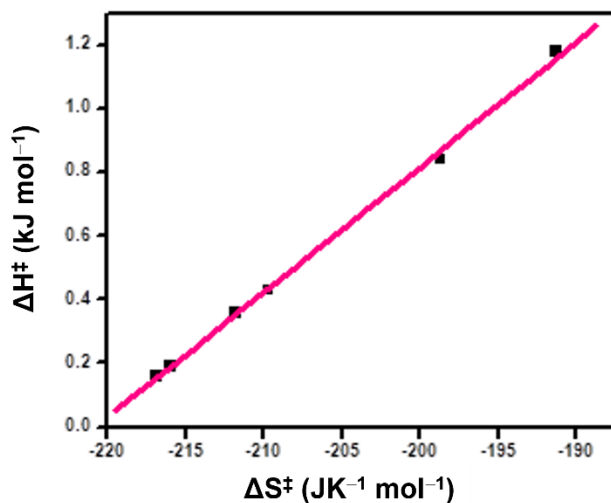
SI Figure S7 Eyring plot for Cis-[Co(dpq)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> in [BMIM]Br medium.  
[complex] =  $4 \times 10^{-4} \text{ mol dm}^{-3}$ ; [Fe(CN)<sub>6</sub>]<sup>4-</sup> =  $0.01 \text{ mol dm}^{-3}$ ; [ $\mu$ ] =  $1.0 \text{ mol dm}^{-3}$ .



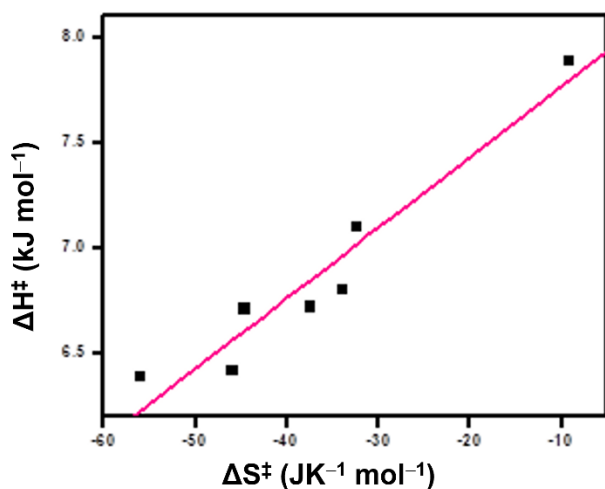
SI Figure S8 Eyring plot for Cis-[Co(dpqc)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> in [BMIM]Br medium.  
[complex] =  $4 \times 10^{-4} \text{ mol dm}^{-3}$ ; [Fe(CN)<sub>6</sub>]<sup>4-</sup> =  $0.01 \text{ mol dm}^{-3}$ ; [ $\mu$ ] =  $1.0 \text{ mol dm}^{-3}$ .



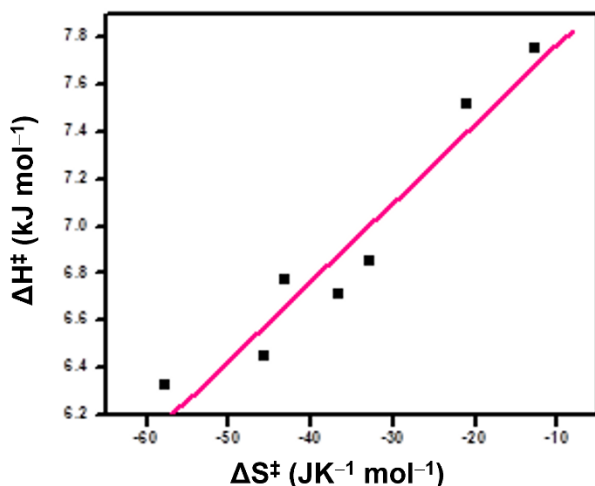
SI Figure S9 Isokinetic plot of the activation parameters for the reduction of Cis-[Co(dpq)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> by ion(II) in DPPC medium. [complex] = 4 x 10<sup>-4</sup> mol dm<sup>-3</sup>; [Fe<sup>2+</sup>] = 0.01 mol dm<sup>-3</sup>; [μ] = 1.0 mol dm<sup>-3</sup>. Note: Entropy and Enthalpy of activation is symbolized ΔS<sup>‡</sup> and ΔH<sup>‡</sup>.



SI Figure S10 Isokinetic plot of the activation parameters for the reduction of Cis-[Co(dpqc)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> by ion(II) in aqueous solutions. [complex] = 4 x 10<sup>-4</sup> mol dm<sup>-3</sup>; [Fe(CN)<sub>6</sub>]<sup>4-</sup> = 0.01 mol dm<sup>-3</sup>; [μ] = 1.0 mol dm<sup>-3</sup>. Note: Entropy and Enthalpy of activation is symbolized ΔS<sup>‡</sup> and ΔH<sup>‡</sup>.



SI Figure S11 Isokinetic plot of the activation parameters for the reduction of Cis-[Co(dpq)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> by ion(II) in [BMIM]Br medium. [complex] = 4 x 10<sup>-4</sup> mol dm<sup>-3</sup>; [Fe(CN)<sub>6</sub>]<sup>4-</sup> = 0.01 mol dm<sup>-3</sup>; [μ] = 1.0 mol dm<sup>-3</sup>. Note: Entropy and Enthalpy of activation is symbolized  $\Delta S^\ddagger$  and  $\Delta H^\ddagger$ .



SI Figure S12 Isokinetic plot of the activation parameters for the reduction of Cis-[Co(dpqc)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> by ion(II) in [BMIM]Br medium. [complex] = 4 x 10<sup>-4</sup> mol dm<sup>-3</sup>; [Fe(CN)<sub>6</sub>]<sup>4-</sup> = 0.01 mol dm<sup>-3</sup>; [μ] = 1.0 mol dm<sup>-3</sup>. **Note:** Entropy and Enthalpy of activation is symbolized  $\Delta S^\ddagger$  and  $\Delta H^\ddagger$ .

## Tables

SI Table S1. Second-order rate constants for the reduction of cobalt(III) complex ion by  $\text{Fe}^{2+}$  in DPPC under various temperatures.  $\text{Cis-}[\text{Co}(\text{dpq})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3 = 4 \times 10^{-4} \text{ mol dm}^{-3}$ ,  $\mu = 1.0 \text{ mol dm}^{-3}$ ,  $[\text{Fe}(\text{CN})_6]^{4-} = 0.01 \text{ mol dm}^{-3}$

$[\text{DPPC}] \times 10^5$ ( $\text{mol dm}^{-3}$ )	$k \times 10^2, \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$					
	298K	303K	308K	323K	328K	333K
2.0	16.2	16.5	17.0	17.4	18.2	19.1
3.0	15.5	16.2	16.4	18.0	19.0	19.4
4.0	14.9	15.3	15.9	19.2	19.5	20.5
5.0	14.5	14.6	15.2	19.7	19.9	20.8
6.0	13.7	14.0	14.8	20.3	20.8	21.5
7.0	12.2	13.3	14.2	20.7	21.7	22.5

SI Table S2. Second-order rate constants for the reduction of cobalt(III) complex ion by  $\text{Fe}^{2+}$  in DPPC under various temperatures.  $\text{Cis-}[\text{Co}(\text{dpqc})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3 = 4 \times 10^{-4} \text{ mol dm}^{-3}$ ,  $\mu = 1.0 \text{ mol dm}^{-3}$ ,  $[\text{Fe}(\text{CN})_6]^{4-} = 0.01 \text{ mol dm}^{-3}$

$[\text{DPPC}] \times 10^5$ ( $\text{mol dm}^{-3}$ )	$k \times 10^2, \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$					
	298K	303K	308K	323K	328K	333K
2.0	17.3	17.4	17.8	17.9	18.6	19.2
3.0	16.8	17.3	17.5	18.0	19.0	19.6
4.0	16.6	17.0	17.3	18.5	19.3	20.0
5.0	16.4	16.8	16.9	19.0	19.5	20.5
6.0	15.9	16.2	16.3	19.5	20.2	21.8
7.0	15.3	15.4	15.9	20.0	20.5	22.8

SI Table S3. Second-order rate constants for the reduction of cobalt(III) complex ion by  $\text{Fe}^{2+}$  in the presence of [BMIM]Br medium under various temperatures. Cis- $[\text{Co}(\text{dpq})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3 = 4 \times 10^{-4} \text{ mol dm}^{-3}$ ,  $\mu = 1.0 \text{ mol dm}^{-3}$ ,  $[\text{Fe}(\text{CN})_6]^{4-} = 0.01 \text{ mol dm}^{-3}$

$[(\text{BMIM})\text{Br}] \times 10^3,$ $\text{mol dm}^{-3}$	$k \times 10^2, \text{dm}^3 \text{mol}^{-1} \text{s}^{-1}$					
	298K	303K	308K	313K	318K	323K
1.4	4.0	4.2	6.5	8.9	14.7	23.0
1.6	5.2	5.5	7.7	12.0	20.6	27.4
1.8	6.1	7.4	8.5	25.5	31.5	33.7
2.0	6.5	9.4	15.5	28.6	34.8	55.4
2.2	10.5	15.2	21.3	32.1	45.3	63.7
2.4	11.4	20.2	24.2	35.2	58.2	77.2
2.6	11.6	21.2	25.6	36.2	59.6	80.4

SI Table S4. Second-order rate constants for the reduction of cobalt(III) complex ion by  $\text{Fe}^{2+}$  in the presence of [BMIM]Br medium under various temperatures. Cis- $[\text{Co}(\text{dpqc})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3 = 4 \times 10^{-4} \text{ mol dm}^{-3}$ ,  $\mu = 1.0 \text{ mol dm}^{-3}$ ,  $[\text{Fe}(\text{CN})_6]^{4-} = 0.01 \text{ mol dm}^{-3}$

$[(\text{BMIM})\text{Br}]$ $\times 10^3, \text{mol dm}^{-3}$	$k \times 10^2, \text{dm}^3 \text{mol}^{-1} \text{s}^{-1}$					
	298K	303K	308K	313K	318K	323K
1.4	4.3	4.6	7.0	9.5	15.4	23.5
1.6	5.6	5.9	8.1	17.8	23.5	29.5
1.8	6.5	7.6	8.3	25.9	31.8	41.0
2.0	6.8	10.0	15.9	29	35.0	57.0
2.2	11.0	15.5	21.6	32.9	45.9	64.2
2.4	11.8	21.1	27.4	36.9	67.8	80.8
2.6	12.5	22.9	26.5	39.5	76.4	82.4



SI Table S5. Activation parameters for the reduction of Cis-[Co(dpq)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> ,  $\mu = 1.0 \text{ mol dm}^{-3}$  in DPPC medium. **Note:** Entropy and Enthalpy of activation is symbolized  $\Delta S^\ddagger$  and  $\Delta H^\ddagger$ .

$[\text{DPPC}] \times 10^5$ (mol dm <sup>-3</sup> )	$\Delta H^\ddagger$	$-\Delta S^\ddagger$
2.0	1.26	193.3
3.0	2.01	172.5
4.0	3.43	133.4
5.0	4.57	106.0
6.0	5.79	74.20
7.0	6.33	59.40
8.0	8.02	15.80

SI Table S6. Activation parameters for the reduction of Cis-[Co(dpqc)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> ,  $\mu = 1.0 \text{ mol dm}^{-3}$  in DPPC medium. **Note:** Entropy and Enthalpy of activation is symbolized  $\Delta S^\ddagger$  and  $\Delta H^\ddagger$ .

$[\text{DPPC}] \times 10^5$ (mol dm <sup>-3</sup> )	$\Delta H^\ddagger$	$-\Delta S^\ddagger$
2.0	0.16	216.9
3.0	0.19	216.0
4.0	0.36	211.8
5.0	0.43	209.7
6.0	0.84	198.7
7.0	1.18	191.3

SI Table S7. Activation parameters for the reduction of Cis-[Co(dpq)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> ,  $\mu = 1.0 \text{ mol dm}^{-3}$  in [BMIM]Br medium. **Note:** Entropy and Enthalpy of activation is symbolized  $\Delta S^\ddagger$  and  $\Delta H^\ddagger$ .

$[(\text{BMIM})\text{Br}] \times 10^3, \text{ mol dm}^{-3}$	$\Delta H^\ddagger$	$-\Delta S^\ddagger$
1.4	6.39	55.9
1.6	6.42	45.9
1.8	6.71	44.6
2.0	6.72	37.4
2.2	6.80	33.9
2.4	7.10	32.4
2.6	7.89	-9.2

SI Table S8. Activation parameters for the reduction of Cis-[Co(dpqc)<sub>2</sub>(C<sub>12</sub>H<sub>25</sub>NH<sub>2</sub>)<sub>2</sub>](ClO<sub>4</sub>)<sub>3</sub> ,  $\mu = 1.0 \text{ mol dm}^{-3}$  in [BMIM]Br medium. **Note:** Entropy and Enthalpy of activation is symbolized  $\Delta S^\ddagger$  and  $\Delta H^\ddagger$ .

$[(\text{BMIM})\text{Br}] \times 10^3, \text{ mol dm}^{-3}$	$\Delta H^\ddagger$	$-\Delta S^\ddagger$
1.4	6.33	57.7
1.6	6.45	45.7
1.8	6.77	43.2
2.0	6.71	36.5
2.2	6.85	32.8
2.4	7.52	20.9
2.6	7.75	12.6