

Supporting Information

Deactivation study of K promoted Ru/carbon catalyst for ammonia synthesis

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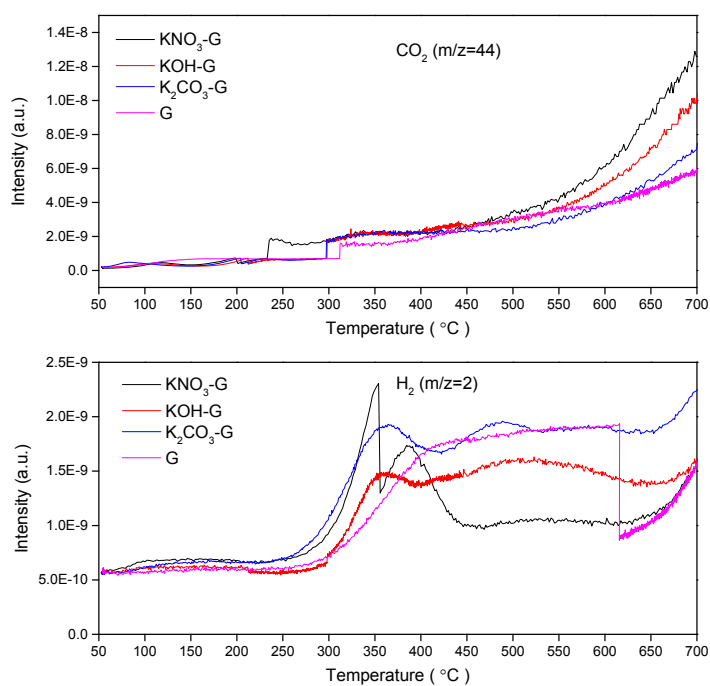


Fig. S1 CO-TPR profiles of carbon (G), and carbon doped with different K precursors (KNO₃-G, KOH-G and K₂CO₃-G)

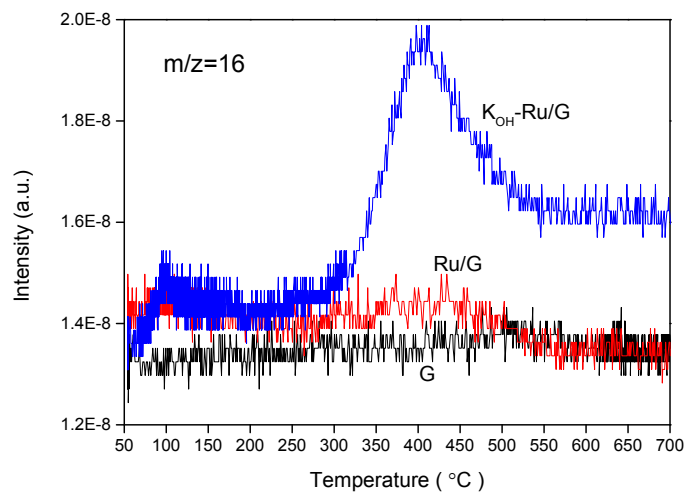


Fig. S2 The mass spectrum with $m/z = 16$ for G, Ru/G and K_{OH} -Ru/G obtained from CO-TPR study.

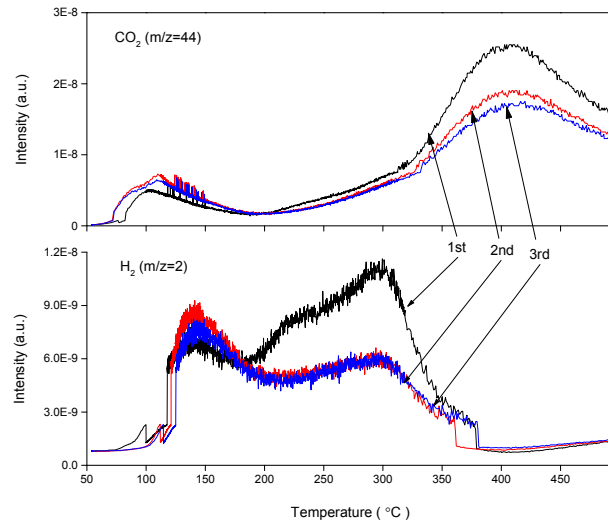


Fig. S3 CO-TPR profiles for $\text{K}_{\text{OH}}\text{-Ru/G}$. Rehydration by hydrogen reduction the sample at 500 °C between consecutive cycles.

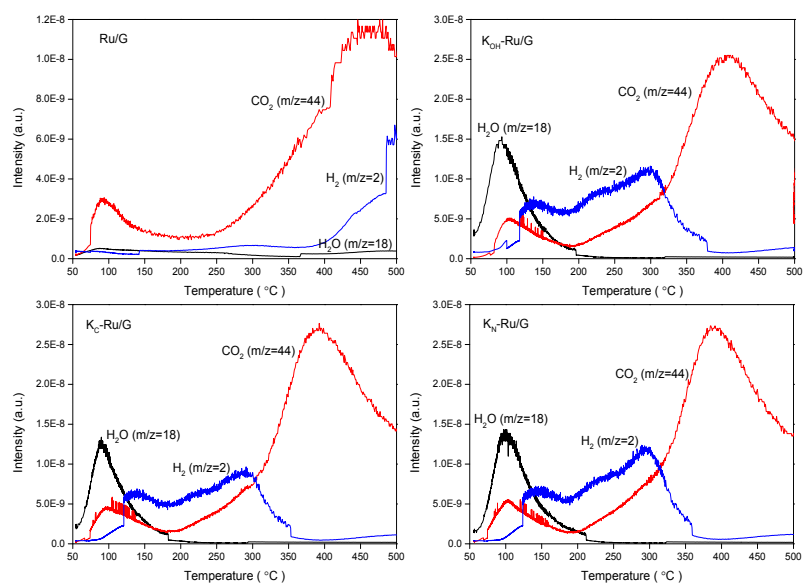


Fig. S4 CO-TPR profiles for unpromoted Ru/G and K-promoted Ru/G catalysts.

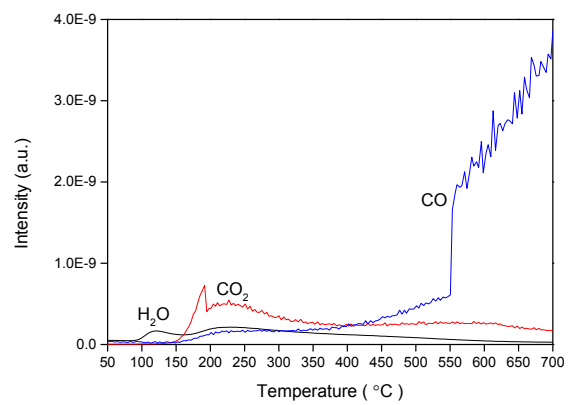


Fig. S5 Ar-TPD profiles of commercial carbon.

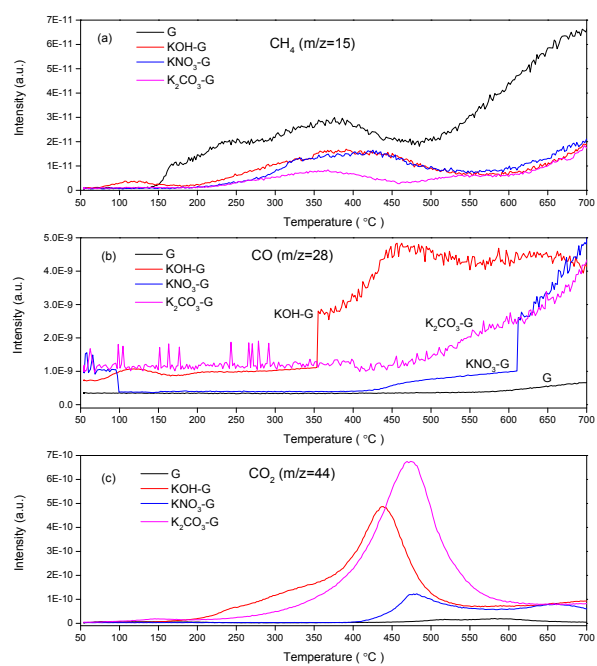


Fig. S6 H₂-TPR profiles of carbon and K-doped carbon materials with hydrogen reduction (a) CH₄ (m/z=15), (b) CO (m/z=28) and (c) CO₂ (m/z=44).

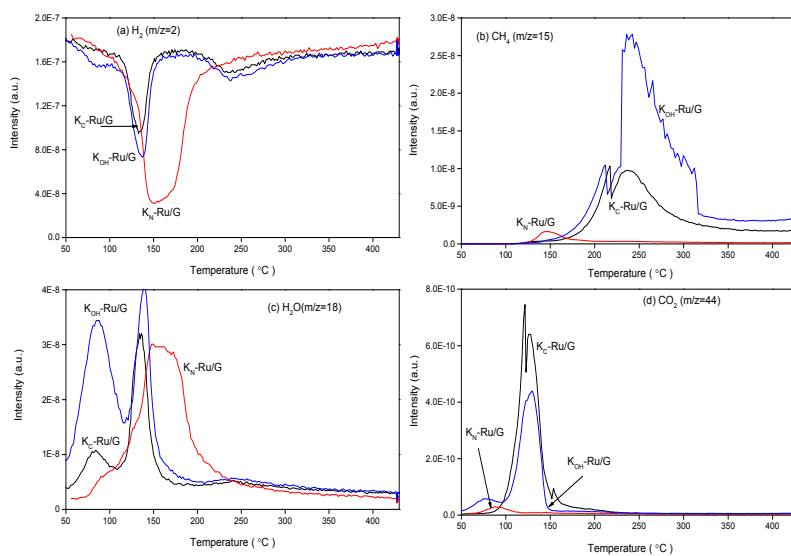


Fig. S7 H_2 -TPR profiles of K-promoted Ru/G catalysts without hydrogen treatment.

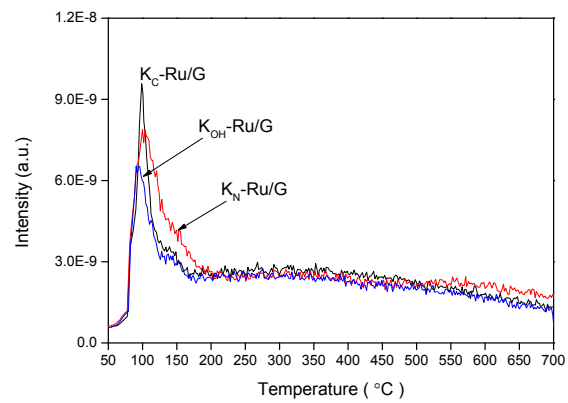


Fig. S8 The mass spectrum with $m/z = 18$ of K_{OH} -Ru/G, K_C -Ru/G and K_N -Ru/G obtained from CO-TPR study.

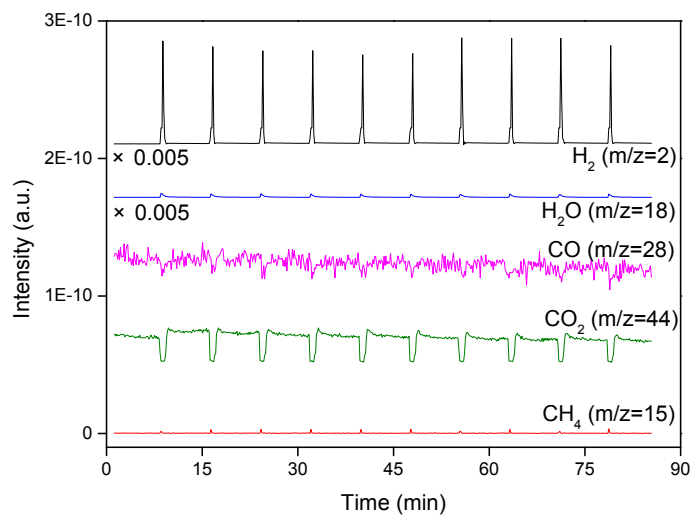


Fig. S9 H₂ pulse chemisorption results at 400 °C over blank sample

Table S1 The peak areas of hydrogen obtained from mass spectroscopy during H₂ pulse

chemisorption

Pulse number	Sample			
	Blank sample	Fresh K _{OH} -Ru/G	K _{OH} -Ru/G treated at 400 °C for 20 h	K _{OH} -Ru/G treated at 500 °C for 20 h
1	3.50E-09	1.50E-09	1.69E-09	1.06E-09
2	2.80E-09	1.74E-09	2.33E-09	3.00E-09
3	2.83E-09	2.03E-09	1.85E-09	1.86E-09
4	2.84E-09	6.08E-09	3.13E-09	1.82E-09
5	2.86E-09	3.17E-09	5.28E-09	1.88E-09
6	2.87E-09	2.32E-09	4.08E-09	1.92E-09
7	3.52E-09	6.71E-09	5.55E-09	3.91E-09
8	2.91E-09	4.12E-09	3.58E-09	3.01E-09
9	3.85E-09	2.19E-09	5.56E-09	2.36E-09
10	2.90E-09	6.03E-09	3.15E-09	1.75E-09
Average area	3.09E-09	3.59E-09	3.62E-09	2.26E-09