

**Table S1** HPLC Mass Table for urea pyrolysis on the catalysts under dry N<sub>2</sub>.

	Temp. (°C)	Mass (mg)	Urea (mg)	CYA (mg)	Biu (mg)	Mel (mg)	Total recovery (%)
urea	100	10.0	9.787	-	-	-	97.9
	150	8.2	8.012	0.021	0.060	0.014	98.9
	200	8.4	4.793	0.215	2.732	0.015	92.3
	250	7.5	3.483	1.975	0.922	0.026	85.4
	300	5.4	1.378	1.833	1.041	0.009	78.2
	350	1.9	1.332	0.018	0.077	0.006	74.9
	400	1.0	0.757	0.003	0.063	0.005	82.8
	450	-	0.508	0.001	0.015	0.004	-
urea /TiO <sub>2</sub>	100	19.4	9.595	-	-	-	98.9
	150	17.3	6.763	0.004	0.395	-	94.2
	200	16	1.748	1.601	2.123	0.027	87.3
	250	13.3	1.502	1.271	0.486	0.024	91.2
	300	11.2	0.697	0.144	0.624	0.021	99.1
	350	-	0.637	0.002	0.122	0.020	-
	400	-	0.240	-	0.017	-	-
	450	-	0.156	-	0.005	-	-
urea /1% V-Ti	100	19.0	8.979	-	-	-	94.5
	150	16.3	6.030	-	0.345	-	93.7
	200	16.6	0.817	1.910	2.876	0.033	79.4

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250	13.1	0.569	1.833	0.676	0.031	86.4
300	11.8	0.619	0.075	1.371	0.028	91.0
350	-	0.532	0.002	0.048	0.014	-
400	-	0.192	-	0.008	-	-
450	-	0.066	-	-	-	-

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**Table S2** Characteristic vibrational IR signals for urea and their pyrolysis byproducts.

Byproduct	Urea				Biu		CYA		Mel		Amme		
Sample	$\nu_{as} NH_2$	$\beta NH_2$	$\nu CO$	$\nu N-C-N$	$\nu CO$	$\nu CN$	$\nu OH$	RV <sup>a</sup>	$\nu NH$	RV <sup>a</sup>	$\nu CO$	$\delta CN$	
Urea	RT <sup>b</sup>	3446,3346	1618,1061	1678	1464,1153								
	150	3444,3346	1619,1065	1674	1460,1155								
	200	3413,3331	1620,1066	1672	1456,1163	1329	3201		3456				
	250	3423,3332	1055	1673	1464,1149	1083		3209	1398	3464	1722		
	300	3318	1053	1673	1466	1093		3199	1398	1722 1267			
	350	3327	1619,1043	1672	1464	1095		3197		1545		1734	1269
	400	3329	1618,1045	1670	1464	1330	1097		1544		1734	1273	
	450	3440	1619	1668	1466	1326		1545		1734	1263		
urea/ TiO <sub>2</sub>	RT <sup>b</sup>	3442,3340	1619,1057	1681	1459,1155								
	150	3434,3336	1614,1074	1672	1454,1157	1334	3205						
	200	3426,3336	1619,1074	1457,1164		1332	3196	1403		1236			
	250	3444,3428	1621,1054	1469			3195	1398		1720			
	300	3423	1628	1467									
	350	3420	1629										
1% V- Ti	RT <sup>b</sup>	3440,3342	1619,1062	1681	1461,1157								
	150	3444	1623,1062	1670	1454,1160	1340	3203						
	200	3442	1621,1056	1456		1340	1079	1403		1720		1241	
	250	3426,3320	1635,1054	1463	1324	3205		1398		1718			
	300	3417	1629	1459			1726						
350	3420	1629											

<sup>a</sup> RV----Ring vibration; <sup>b</sup> RT----Room temperature;