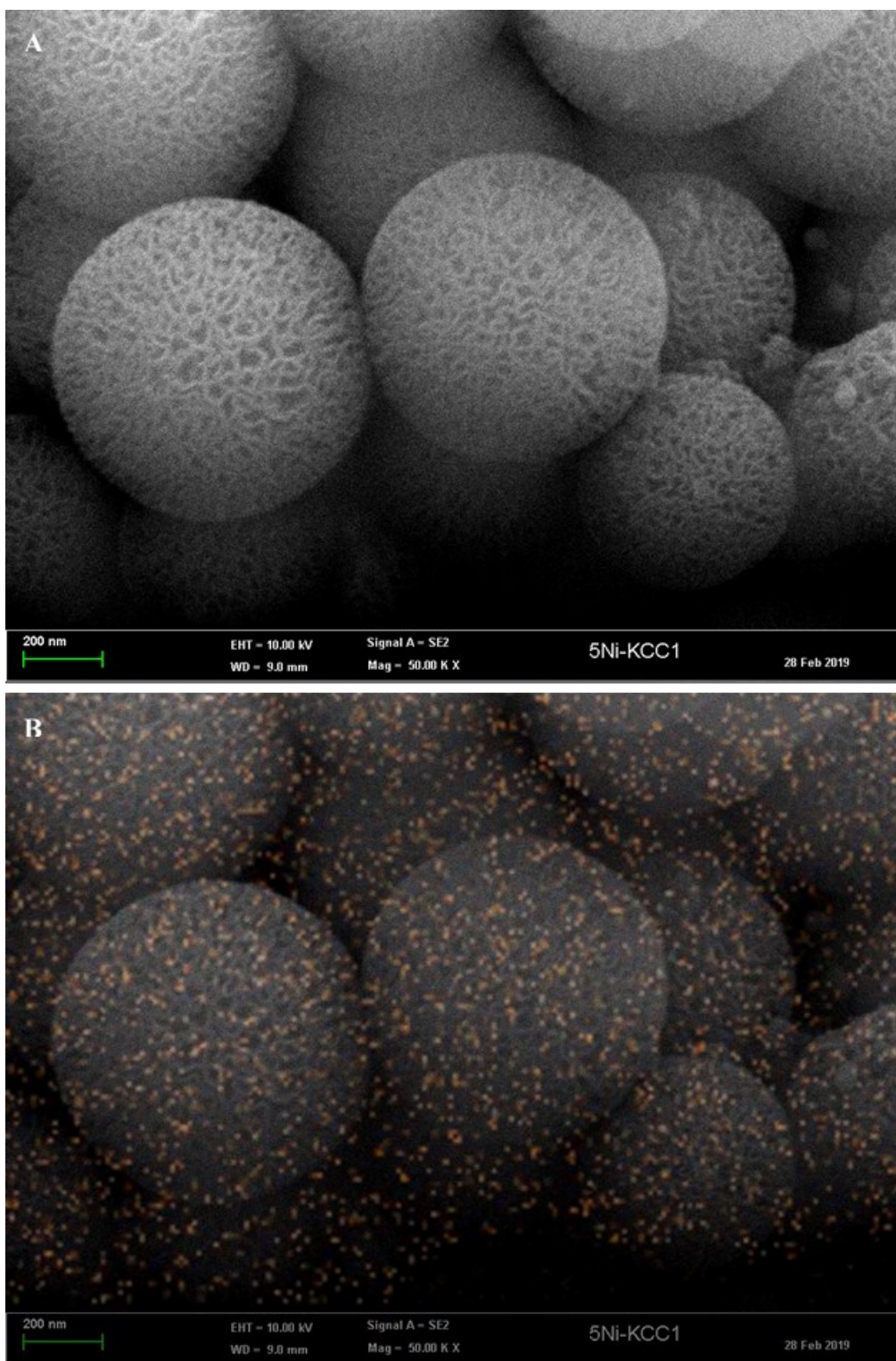
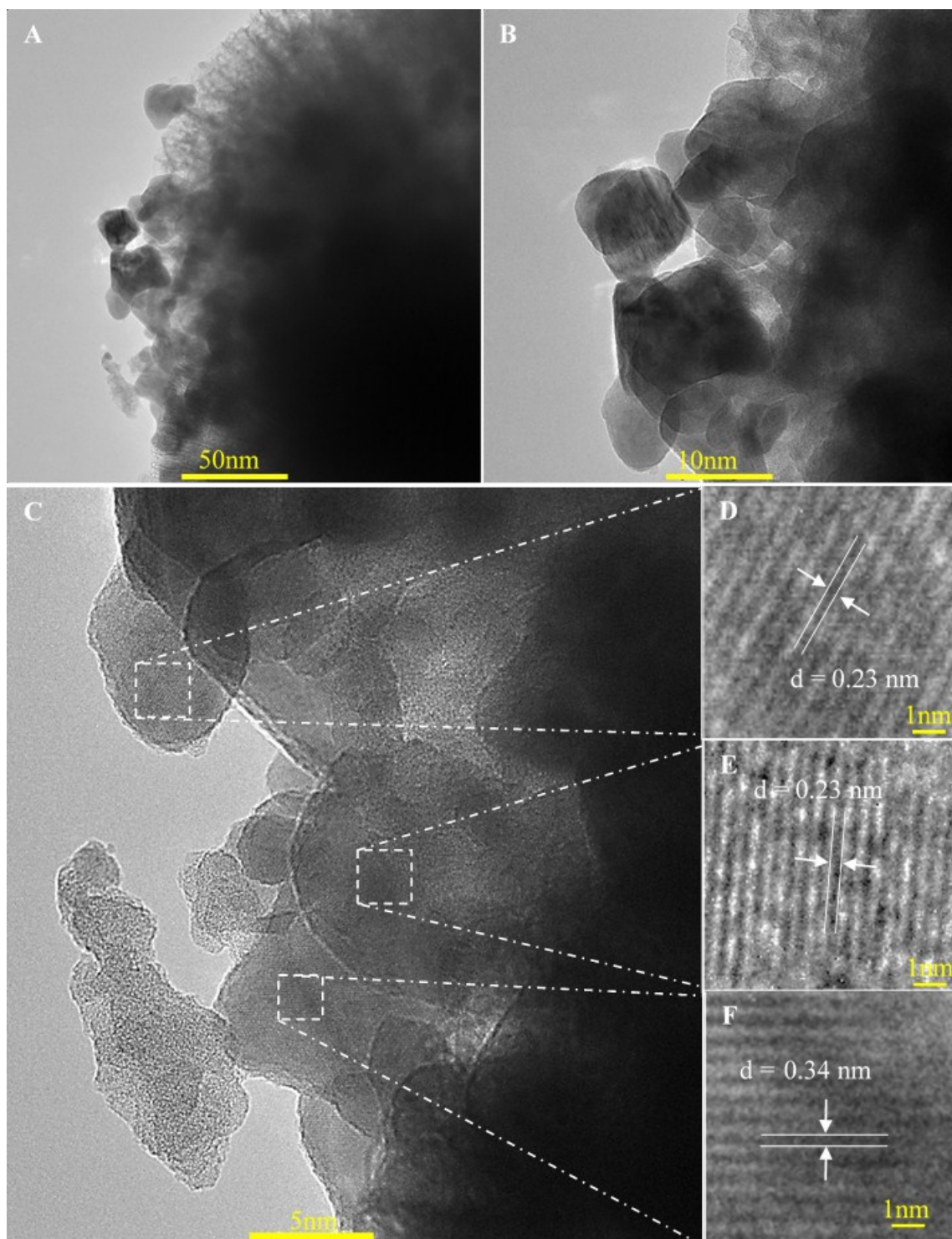


**Table S1** Coded levels for independent variables used in the experimental design

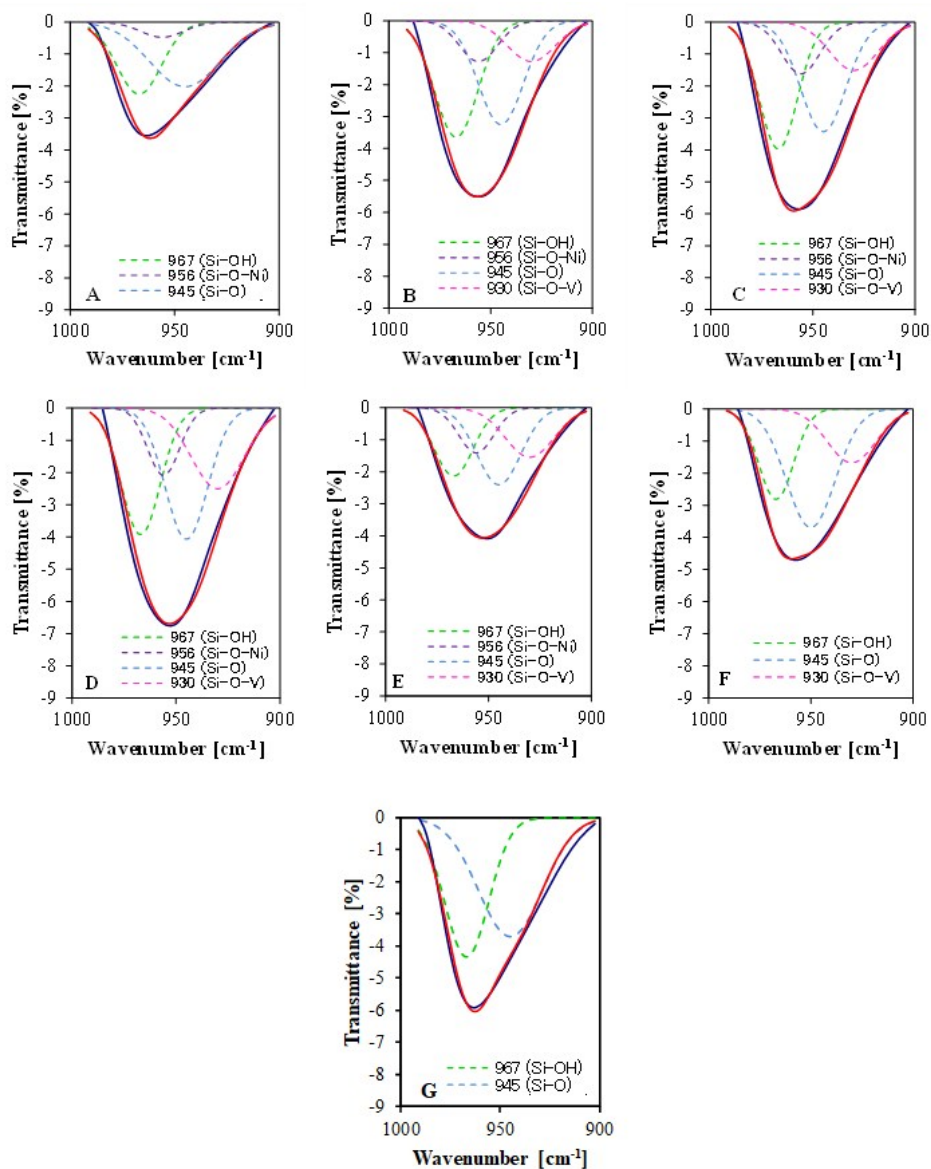
Independent variables	Symbol	Coded levels		
		-1	0	+1
Reaction temperature (K)	A	623	673	723
Reduction temperature (K)	B	573	773	973
H <sub>2</sub> /CO <sub>2</sub> ratio	C	2	4	6



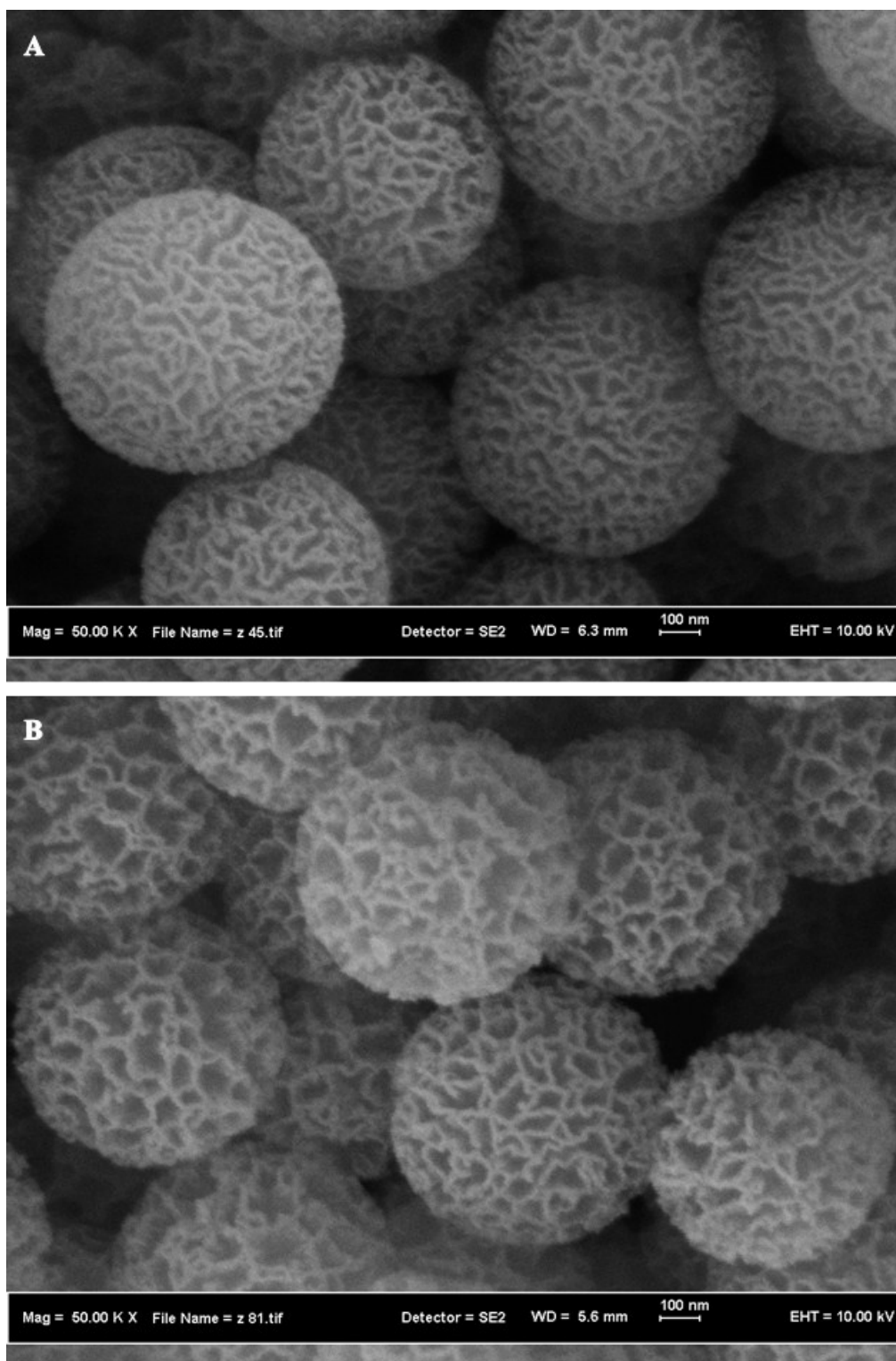
**Figure S1** (A) FESEM image and (B) Ni elemental mapping of 5 Ni/KCC-1



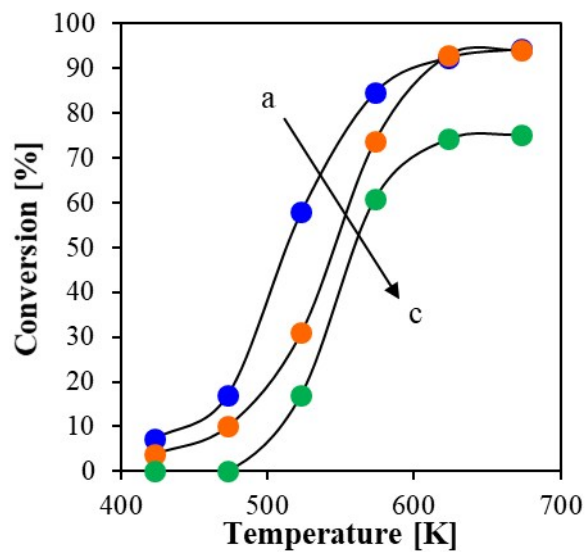
**Figure S2** (A-C) TEM image and (D-F) magnified TEM image showing associated lattice planes of 7.5V<sub>2</sub>O<sub>5</sub>-Ni/KCC-1



**Figure S3** FTIR spectra and Gaussian Curve fitting of band at  $960\text{ cm}^{-1}$  of (a) KCC-1, (b)  $5\text{Ni/KCC-1}$ , (c)  $2.5\text{V}_2\text{O}_5\text{-Ni/KCC-1}$ , (d)  $5\text{V}_2\text{O}_5\text{-Ni/KCC-1}$ , (e)  $7.5\text{V}_2\text{O}_5\text{-Ni/KCC-1}$ , (f)  $10\text{V}_2\text{O}_5\text{-Ni/KCC-1}$  and (g)  $5\text{V}_2\text{O}_5\text{/KCC-1}$



**Figure S4** FESEM image of (A) KCC-1 and (B)  $10\text{V}_2\text{O}_5\text{-Ni/KCC-1}$



**Figure S5** CO<sub>2</sub> conversion at 473–623 K over (a) co-impregnated V<sub>2</sub>O<sub>5</sub> and Ni over KCC-1, (b) Ni impregnated over V<sub>2</sub>O<sub>5</sub>/KCC-1 and (c) V<sub>2</sub>O<sub>5</sub> impregnated over Ni/KCC-1

**Table S2** Experimental design and response value for different conditions

Run no.	Factor			Response (%)	
	A, Reaction temperature (K)	B, Reduction temperature (K)	C, H <sub>2</sub> /CO <sub>2</sub> ratio	Observed	Predicted
1	623	573	2	52.52	52.12
2	623	573	6	63.21	63.29
3	623	973	2	48.32	50.36
4	623	973	6	59.17	60.21
5	723	573	2	74.95	74.25
6	723	573	6	84.86	83.17
7	723	973	2	73.68	73.95
8	723	973	6	80.79	81.54
9	623	773	4	76.43	73.68
10	723	773	4	94.03	95.41
11	673	573	4	80.51	83.22
12	673	973	4	85.61	81.53
13	673	773	2	88.10	86.91
14	673	773	6	96.47	96.29
15	673	773	4	93.93	95.58
16	673	773	4	94.48	95.58