*Supporting information*

# $Nb_2C$ MXene assisted CoNi bimetallic catalysts for hydrogenolysis of aromatic ethers

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**Table S1.** Hydrodeoxygenation of diphenyl ether over various heterogeneous catalysts.

| Entry | Catalyst | T ($^oC$) | $P_{H2}$ (bar) | T (h) | Solv. | Conv. (%) | Ref. |
|---|---|---|---|---|---|---|---|
| 1 | Ru/SBA-15 | 130 | 20 | 6 | [Bmim]$PF_6$ | 100 | [1] |
| 2 | Ru/C | 120 | - | 10 | Isopropanol | >99.0 | [2] |
| 3 | $Pd(OH)_2/C$ | 160 | 1 | 24 | *m*-Xylene + $H_2O$ | >99.0 | [3] |
| 4 | Pd | 130 | 50 | 10 | [Bmim]$PF_6$ + $H_3PO_4$ | >99.0 | [4] |
| 5 | Pd/C+HZSM-5 | 200 | 50 | 2 | $H_2O$ | 100 | [5] |
| 6 | Pd/HY | 200 | 34 | 1 | Decalin | >98.0 | [6] |
| 7 | Pd/C | 200 | 40 | 48 | Methanol | 92.0 | [7] |
| 8 | $RuPd_5/NH_2{-}SiO_2$ | 110 | 10 | 1 | $H_2O$ | 99 | [8] |
| 9 | $Ru_{15}Ni_{85}$ | 95 | 1 | 16 | $H_2O$ | 99 | [9] |
| 10 | Ru/MMT@IL-$SO_3H$ | 200 | 50 | 2 | $H_2O$ | 100 | [10] |
| 11 | $Ni_7Au_3$ | 100 | 10 | 5 | $H_2O$ | 33.7 | [11] |
| 12 | Pd/Ni | 240 | $N_2$ 10 | 1.5 | 2-Propanol | 96 | [12] |
| 13 | $RuCo/CeO_2$ | 200 | 20 | - | Decalin | 100 | [13] |
| 14 | $RuFe/CeO_2$ | 200 | 20 | - | Decalin | 100 | [14] |
| 15 | Ni@SiC | 120 | 6 | 20 | $H_2O$ | 99 | [15] |
| 16 | Ni@IRMOF-74(II) | 120 | 10 | 16 | *p*-Xylene | 96 | [16] |
| 17 | $Ni/SiO_2$ | 150 | 59 | 10 | $H_2O$ | 100 | [17] |
| 18 | $Ni(COD)_2$ + SIPr·HCl NaOtBu, | 120 | 1 | 16 | *m*-Xylene | 100 | [18] |
| 19 | Ni/N-C | 200 | 5 | 3 | *n*-Hexane | 100 | [19] |
| 20 | Co/C@N | 220 | 20 | 6 | *n*-Hexane | 100 | [20] |
| 21 | $Co_2NiO_x$ + $Nb_2C$ | 120 | 5 | 12 | Isopropanol | >99.0 | This work |

**Table S2.** ICP-OES results of different catalysts. [a]

| Entry | Catalysts | Calculateda | ICP-OES tested |
|---|---|---|---|
| 1 | $Co_1Ni_1O_x$ | $Co_1Ni_1O_x$ | $Co_{1.06}Ni_1O_x$ |
| 2 | $Co_2Ni_1O_x$ | $Co_2Ni_1O_x$ | $Co_{2.17}Ni_1O_x$ |
| 3 | $Co_3Ni_1O_x$ | $Co_3Ni_1O_x$ | $Co_{3.36}Ni_1O_x$ |
| 4 | $Co_5Ni_1O_x$ | $Co_5Ni_1O_x$ | $Co_{5.21}Ni_1O_x$ |
| 5 | $Co_1Ni_3O_x$ | $Co_1Ni_3O_x$ | $Co_1Ni_{3.12}O_x$ |
| 6 | $Co_1Ni_5O_x$ | $Co_1Ni_5O_x$ | $Co_1Ni_{5.08}O_x$ |

[a]Calculated from the feed amount of precursor salts.

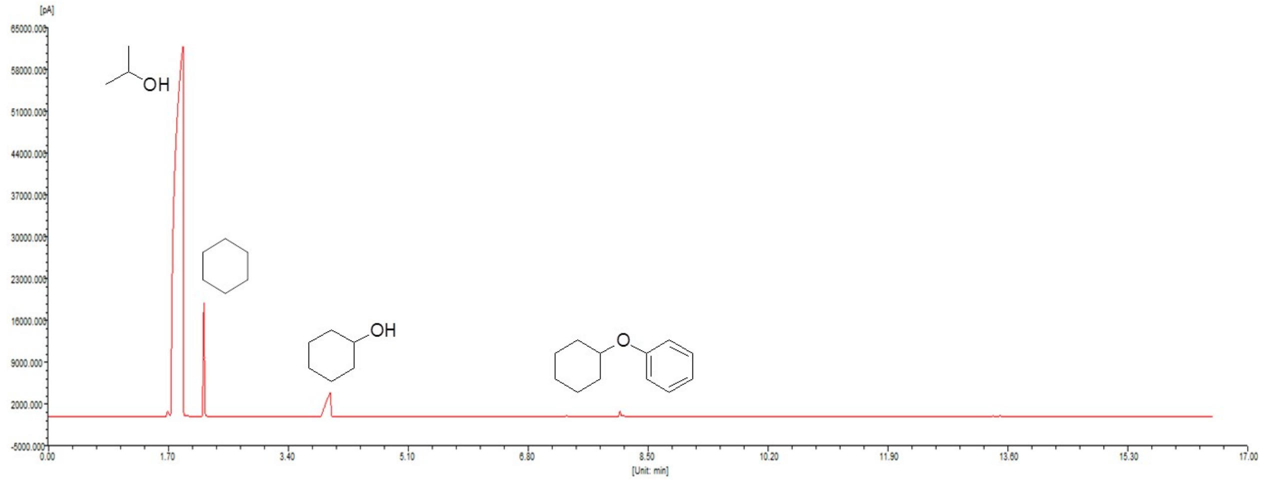


**Figure S1.** GC analysis diagram of hydrogenolysis products of diphenyl ether. (Table 1, entry 5).

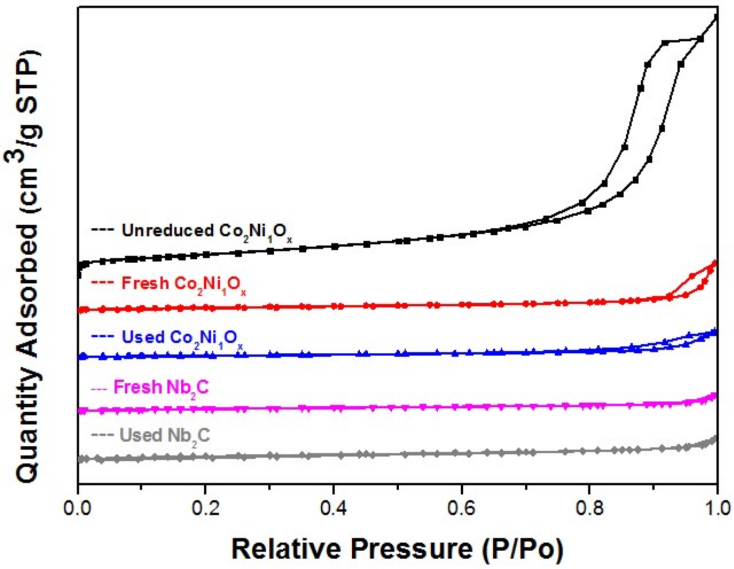


**Figure S2.** $N_2$ adsorption/desorption isotherms of catalysts.

**Table S3.** The analysis results of $N_2$ adsorption/desorption isotherms for catalysts.

| Catalysts | BET surface area ($m^2/g$) | Pore sizea (nm) | Pore volume ($cm^3/g$) |
|---|---|---|---|
| Unreduced $Co_2Ni_1O_x$ | 69 | 14 | 0.22 |
| $Co_2Ni_1O_x$ | 12 | 16 | 0.04 |
| Used $Co_2Ni_1O_x$ | 9 | 15 | 0.03 |
| $Nb_2C$ MXene | 9 | 7 | 0.01 |
| Used $Nb_2C$ MXene | 11 | 12 | 0.02 |

[a]Obtained from the BJH method.

**Table S4.** Surface elemental concentrations determined by XPS.

| Entry | Catalyst | Co 2p (%) | | | Ni 2p (%) | | O 1s (%) | | | Co | Ni | O | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $Co^0$ | $Co^{2+}$ | $Co^{3+}$ | $Ni^0$ | $Ni^{2+}$ | O-H | Vo | O-M | (%) | (%) | (%) | (%) |
| 1 | $Co_5Ni_1O_x$ | 22 | 29 | 49 | 5 | 95 | 45 | 40 | 15 | 27 | 5 | 47 | 21 |
| 2 | $Co_2Ni_1O_x$ | 18 | 25 | 57 | 14 | 86 | 42 | 46 | 12 | 15 | 7 | 46 | 32 |
| 3 | $Co_1Ni_3O_x$ | 20 | 28 | 52 | 16 | 84 | 49 | 32 | 19 | 6 | 18 | 42 | 34 |
| 4 | $Co_1Ni_5O_x$ | 17 | 29 | 54 | 21 | 79 | 42 | 38 | 20 | 4 | 20 | 35 | 41 |
| 5 | Used $Co_2Ni_1O_x$ | 16 | 37 | 48 | 14 | 86 | 46 | 38 | 16 | 13 | 6 | 41 | 40 |

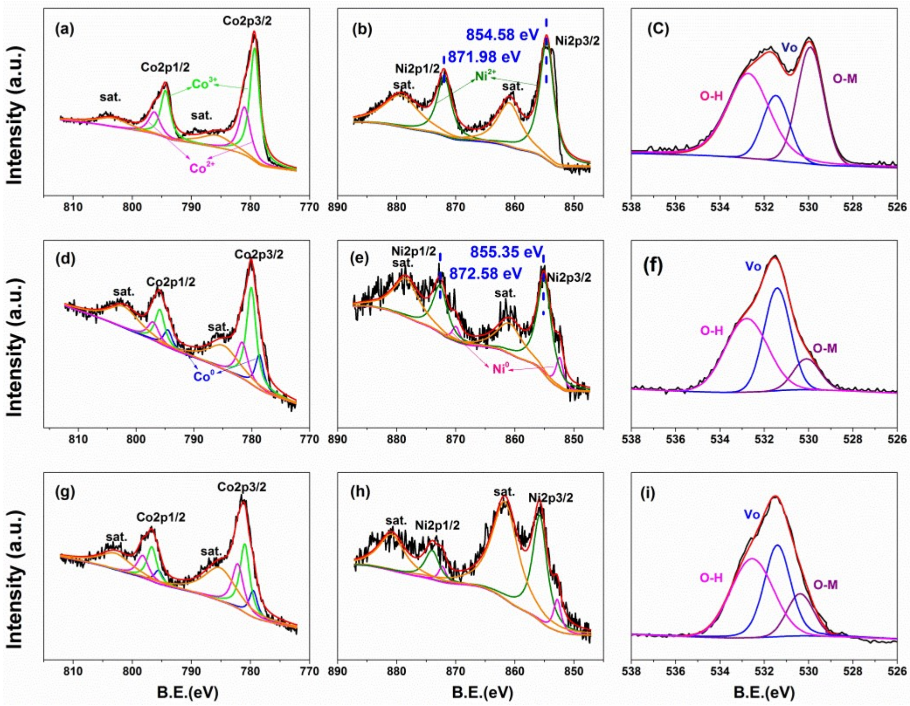


**Figure S3.** XPS spectra of the unreduced $Co_2Ni_1O_x$ ( a, Co 2p; b, Ni 2p; c, O 1s), the fresh $Co_2Ni_1O_x$ (d, Co 2p; e, Ni 2p; f, O 1s ), and the used $Co_2Ni_1O_x$ (g, Co 2p; h, Ni 2p; i, O 1s), respectively.

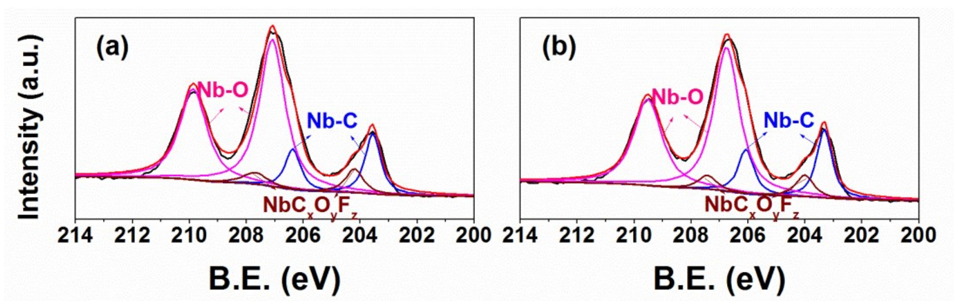


**Figure S4**. XPS spectra of the fresh (a, Nb 3d) and the used (b, Nb 3d) $Nb_2C$ MXene.

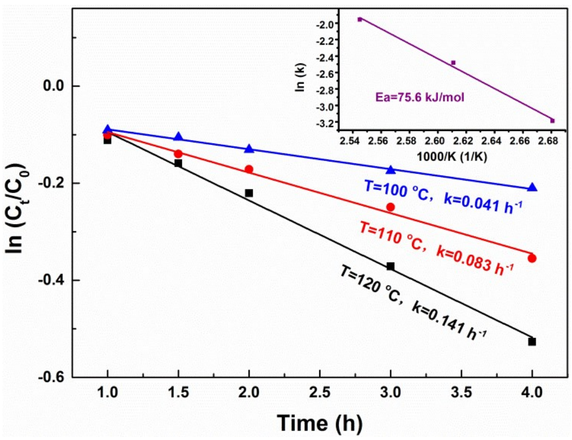


**Figure S5.** Kinetic studies of the hydrogenolysis of DPE. Reaction condition: $Co_2Ni_1O_x$ 20 mg, $Nb_2C$ 20 mg, DPE 0.5 mmol, isopropanol 2 mL and $H_2$ 5 bar.

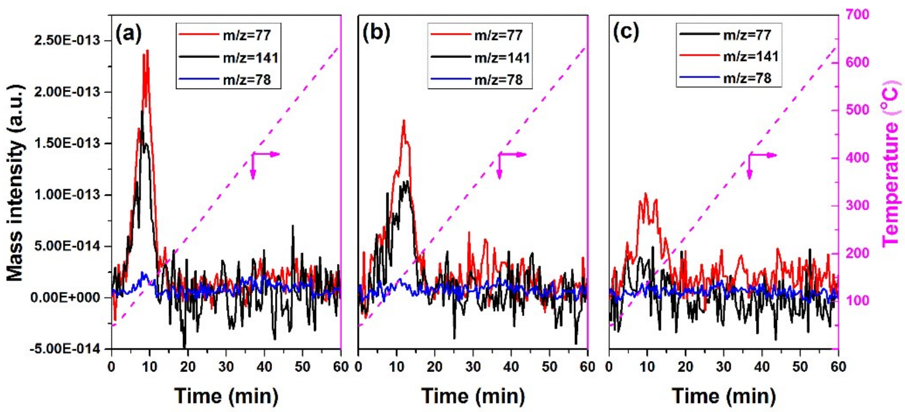


**Figure S6.** The results of DPE-TPD-Mass by using the same amount (a, $Co_2Ni_1O_x$; b, $Co_2Ni_1O_x$+$Nb_2O_5$; c, $Co_2Ni_1O_x$+$Nb_2C$).

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