

## Supporting Information

### Direct synthesis of 2-ethylhexanal via *n*-butanal aldol condensation-selective hydrogenation reaction integration over a highly stable Pd/TiO<sub>2</sub> catalyst

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Table S1 Textural property of Pd/TiO<sub>2</sub> with different Pd loading

| Pd loading | Specific surface area            | Pore volume                       | Average pore size |
|------------|----------------------------------|-----------------------------------|-------------------|
| /wt. %     | /m <sup>2</sup> .g <sup>-1</sup> | /cm <sup>3</sup> .g <sup>-1</sup> | /nm               |
| 0.1        | 169.26                           | 0.37                              | 6.56              |
| 0.3        | 156.55                           | 0.36                              | 7.01              |
| 0.5        | 146.62                           | 0.36                              | 7.41              |
| 0.7        | 139.15                           | 0.35                              | 7.56              |
| 0.9        | 131.70                           | 0.33                              | 7.88              |

Table S2 Effect of calcination temperature on catalytic performance of Pd/TiO<sub>2</sub>

| Temperature /°C | <i>X</i> <sub>BA</sub> /% | <i>S</i> <sub>2EH</sub> /% | <i>S</i> <sub>2E2H</sub> /% |
|-----------------|---------------------------|----------------------------|-----------------------------|
| 100             | 96.5                      | 93.2                       | 0                           |
| 200             | 95.7                      | 96.3                       | 0                           |
| 300             | 95.4                      | 99.2                       | 0                           |
| 400             | 95.2                      | 98.2                       | 0                           |
| 500             | 93.5                      | 97.9                       | 0                           |

Reaction conditions: 180 °C; 6 h; 2 MPa; *m*<sub>BA</sub>:*m*<sub>cat</sub>=10:1.

BA: *n*-butanal; 2EH: 2-ethylhexanal; 2E2H: 2-ethyl-2-hexenal; X: conversion; S: selectivity.

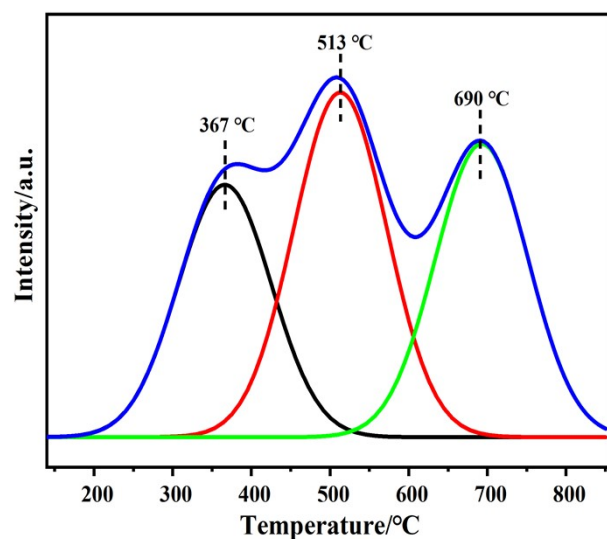


Fig. S1 H<sub>2</sub>-TPR curves of Pd/TiO<sub>2</sub>

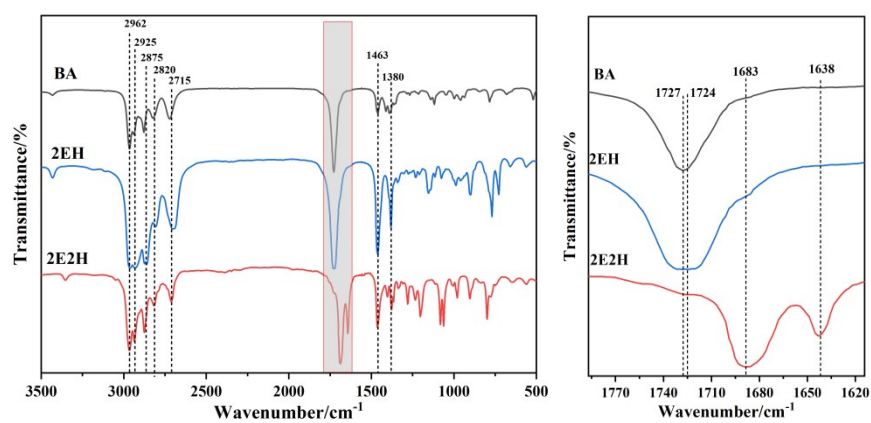


Fig. S2 Infrared spectra of *n*-butanol (BA), 2-ethylhexanal (2EH) and 2-ethyl-2-hexenal (2E2H)