Zn promoted Mg-Al mixed oxides supported gold nanoclusters for direct oxidative esterification of aldehyde to ester

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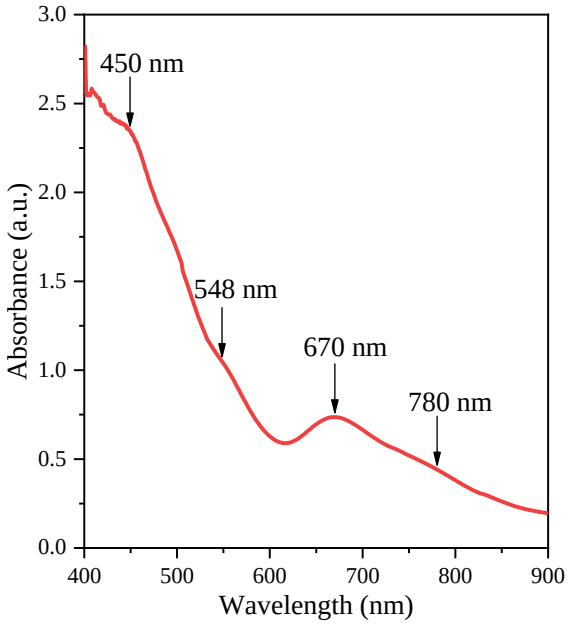

Figure S1. UV-visible spectra of just-synthesized Au_{25} nanoclusters.

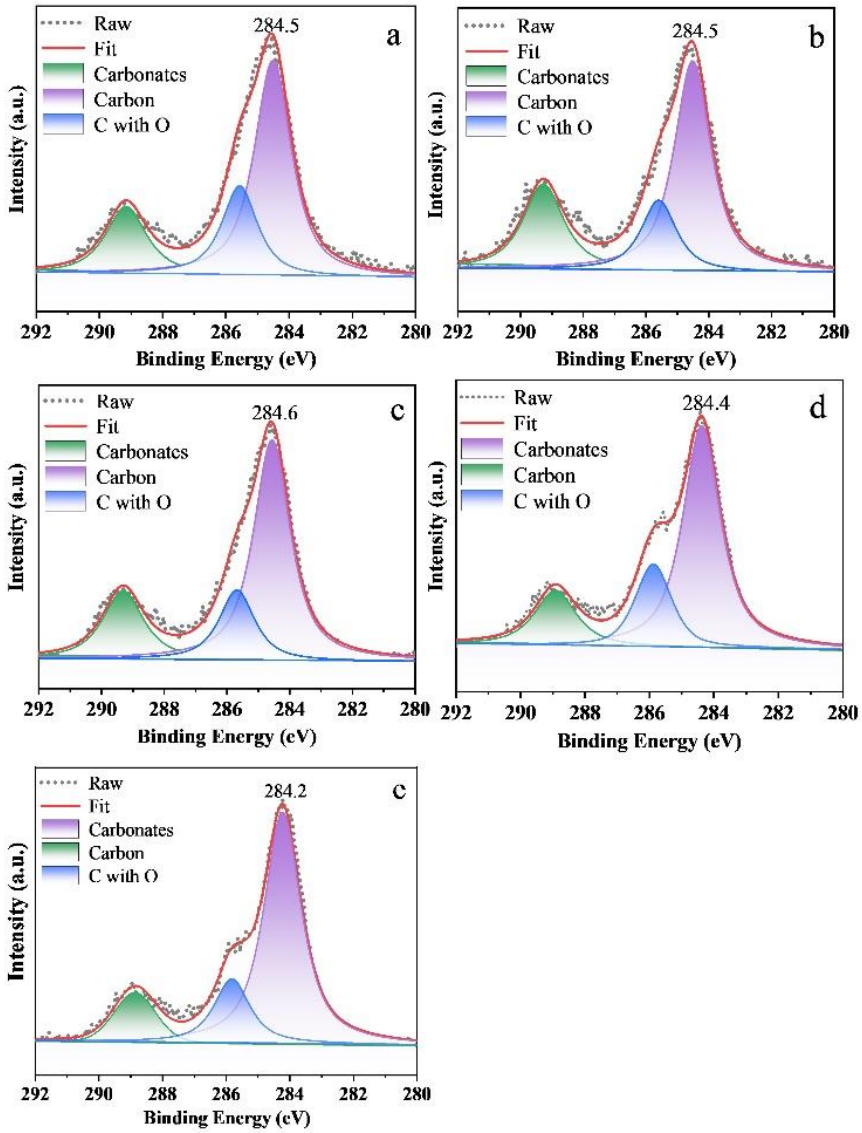

Figure S2. XPS spectra of C 1s of Zn-Mg-Al mixed oxides supported gold catalysts: (a) Au_{25}/MgAl-400; (b) $Au_{25}/Zn_{0.03}$MgAl-400; (c) $Au_{25}/Zn_{0.33}$MgAl-400-; (d) Au_{25}/Zn_3MgAl-400; (e) Au_{25}/ZnAl-400.

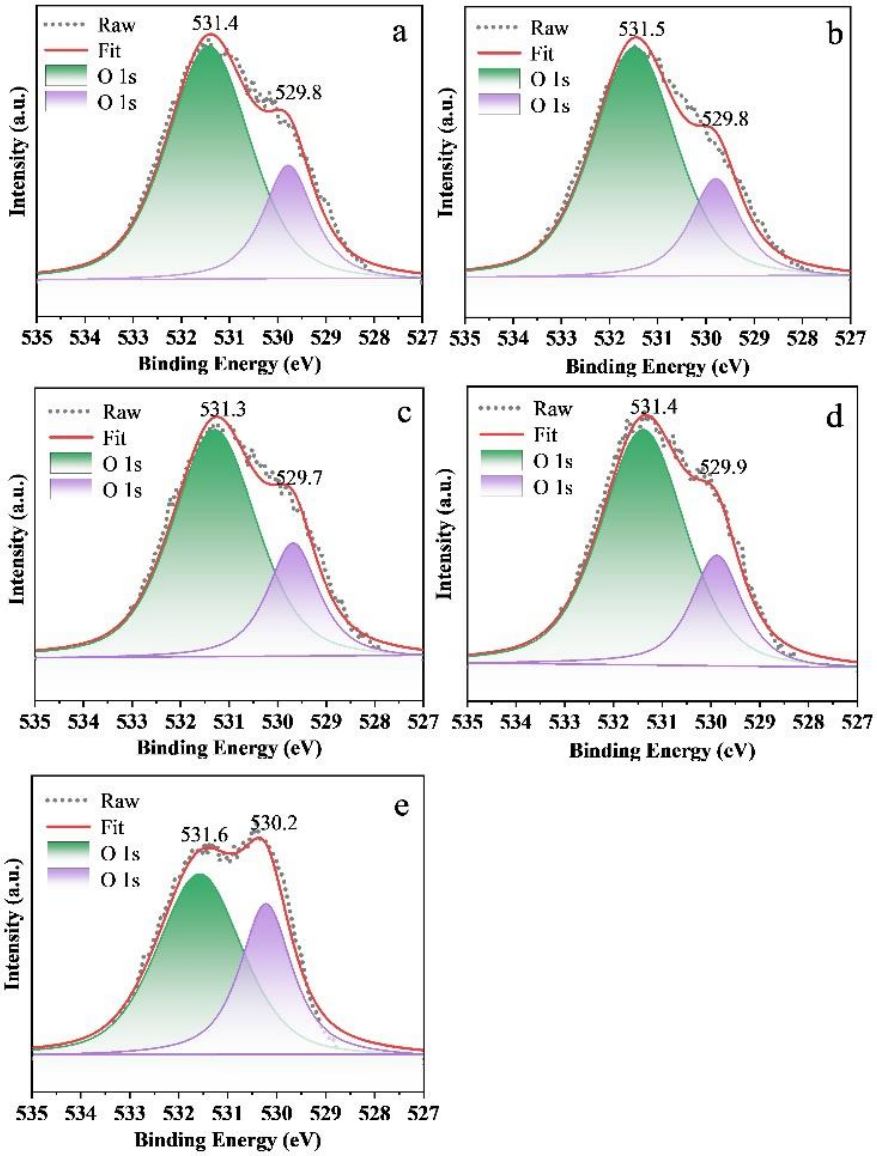

Figure S3. XPS spectra of O 1s of Zn-Mg-Al mixed oxides supported gold catalysts: (a) Au_{25}/MgAl-400; (b) $Au_{25}/Zn_{0.03}$MgAl-400; (c) $Au_{25}/Zn_{0.33}$MgAl-400-; (d) Au_{25}/Zn_3MgAl-400; (e) Au_{25}/ZnAl-400.

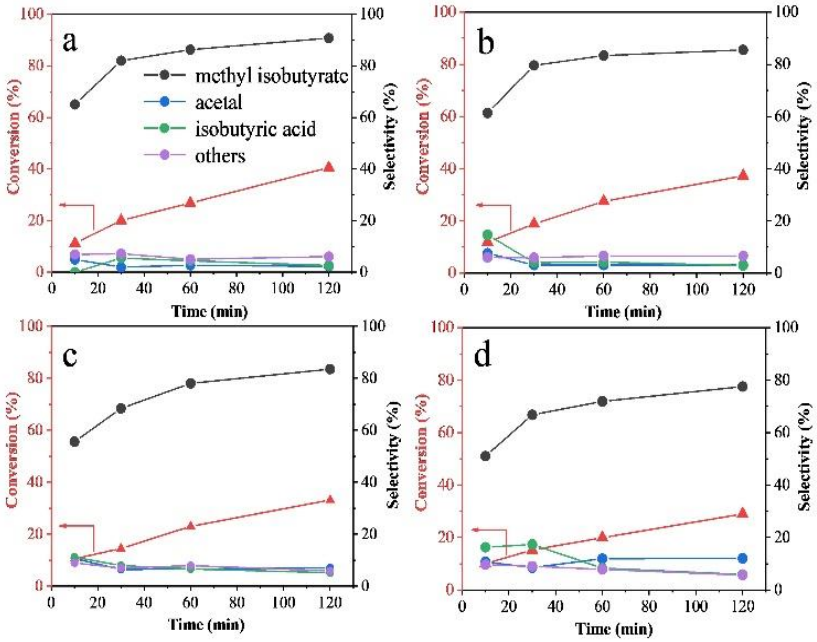

Figure S4. The products distribution of reaction with time courses: (a) Au_{25}/MgAl-400; (b) $Au_{25}/Zn_{0.33}$MgAl-400; (c) Au_{25}/Zn_3MgAl-400; (d) Au_{25}/ZnAl-400. Reaction conditions: 5 mmol of isobutyl aldehyde and 5 mL of methanol; Catalyst: 30 mg; Pressure of O_2: 4 atm; Reaction temperature: 80 ºC.