

Efficient synthesis of epoxybutane from butanediol via a two-step process

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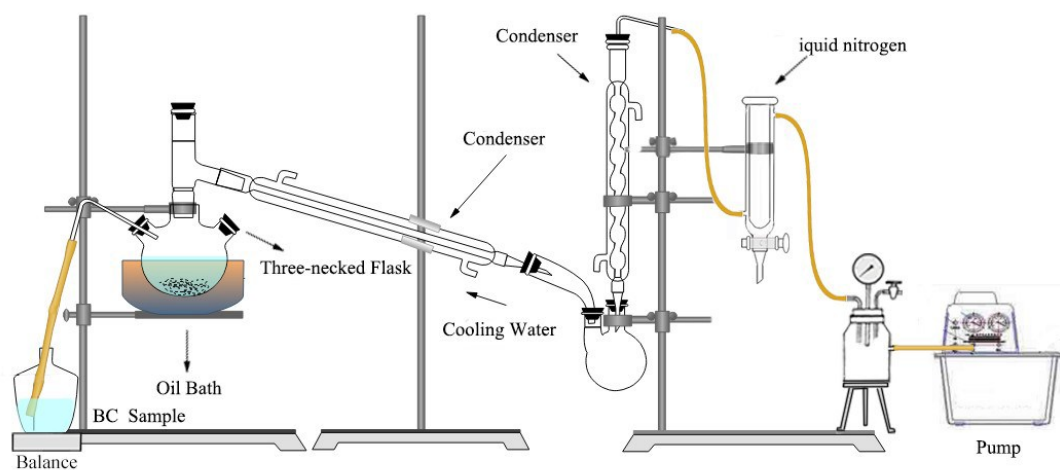


Figure S1 The device for the continuous decarboxylation process.

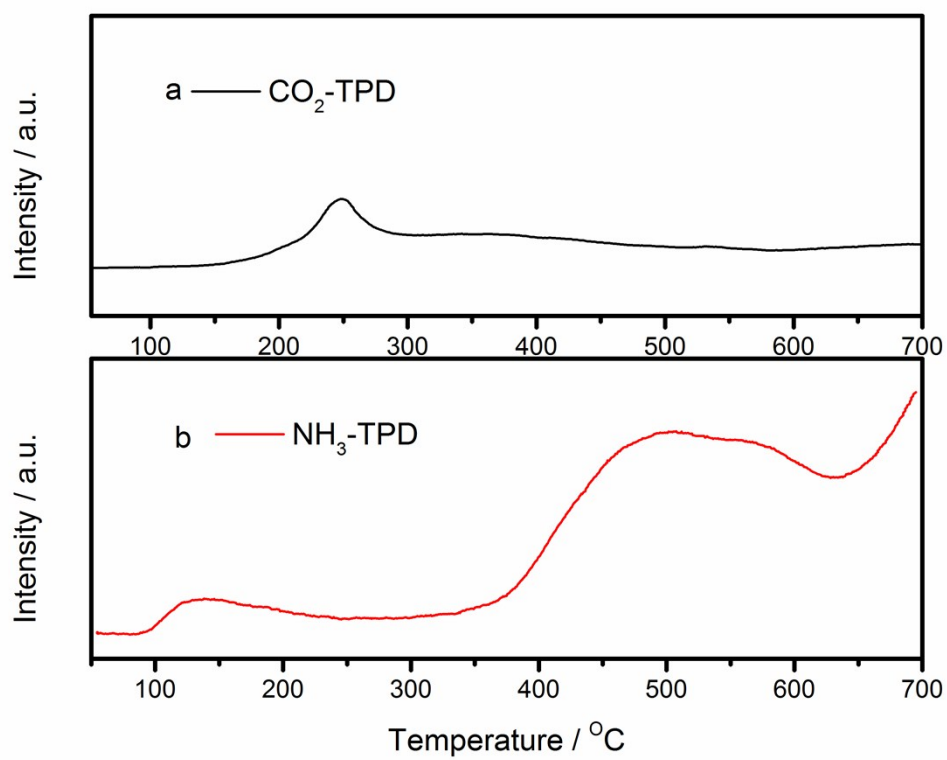


Figure S2 (a) CO₂-TPD, (b) NH₃-TPD of the NaAlO₂

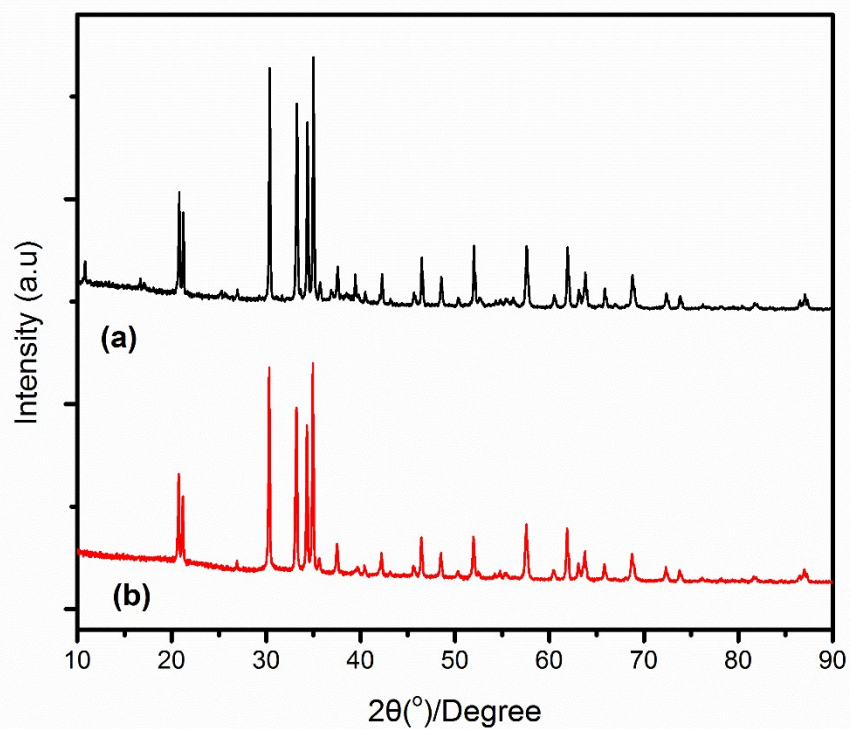


Figure S3 XRD patterns obtained for NaAlO_2 : (a) fresh NaAlO_2 , (b) used NaAlO_2 .

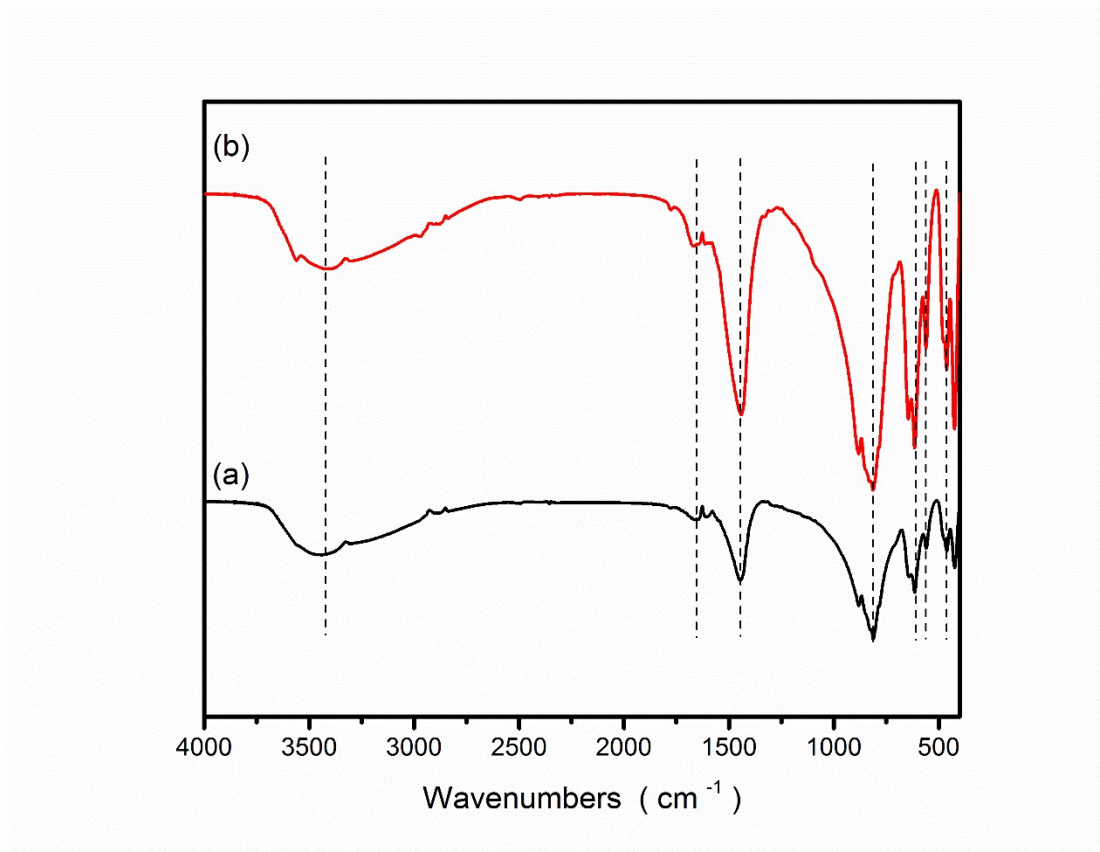


Figure S4 FTIR spectra obtained for NaAlO_2 : (a) Fresh NaAlO_2 , (b) recovered NaAlO_2 .

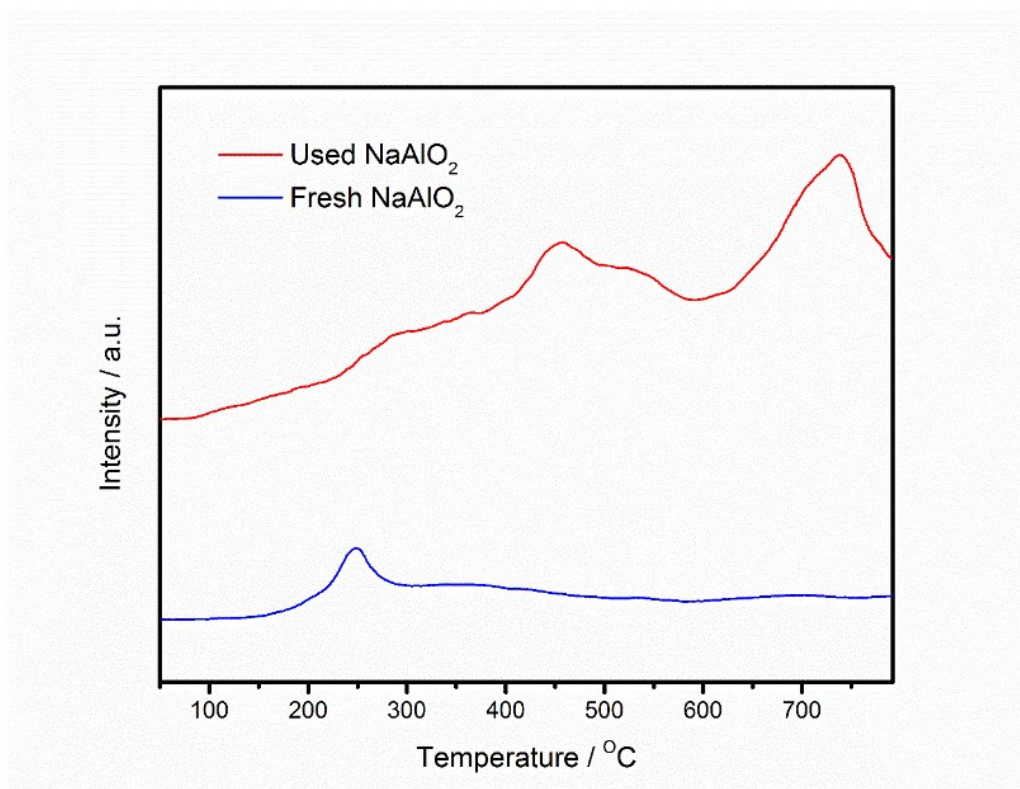


Figure S5 CO₂ -TPD of the NaAlO₂ (both before and after reaction)

Table S1 The BET of the NaAlO₂ (both before and after reaction)

Catalyst	BET surface area (m ² g ⁻¹)
fresh NaAlO ₂	1.7
used NaAlO ₂	13.6

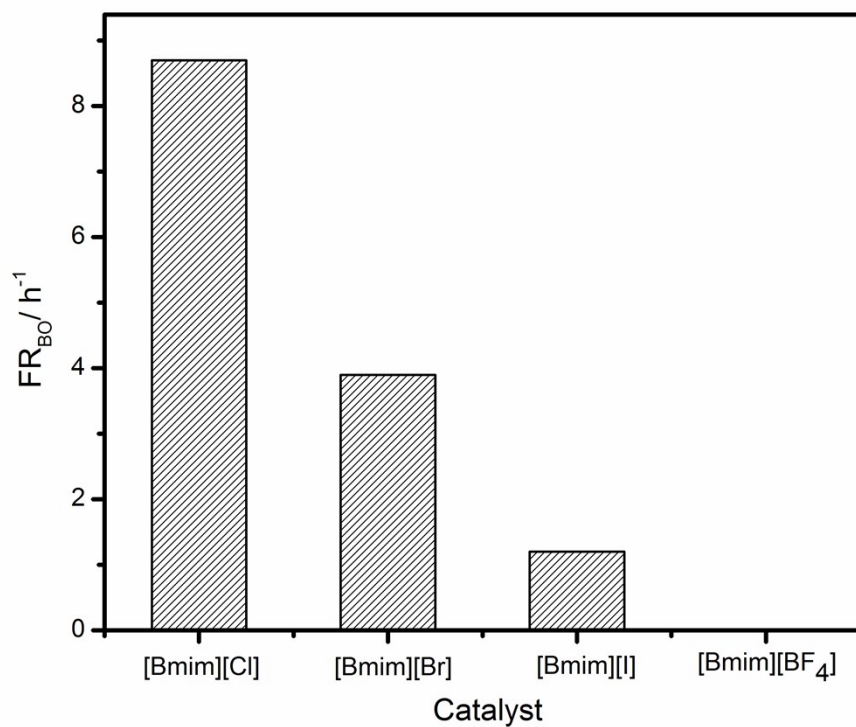


Figure S6. Effect of the catalyst type on the FR_{BO} of the decarboxylation of butenyl carbonate. (Reaction conditions: BC: 40g; catalyst:2g; temperature: 185 °C; reaction time: 2h; vacuum degree: 0.005 MPa.)

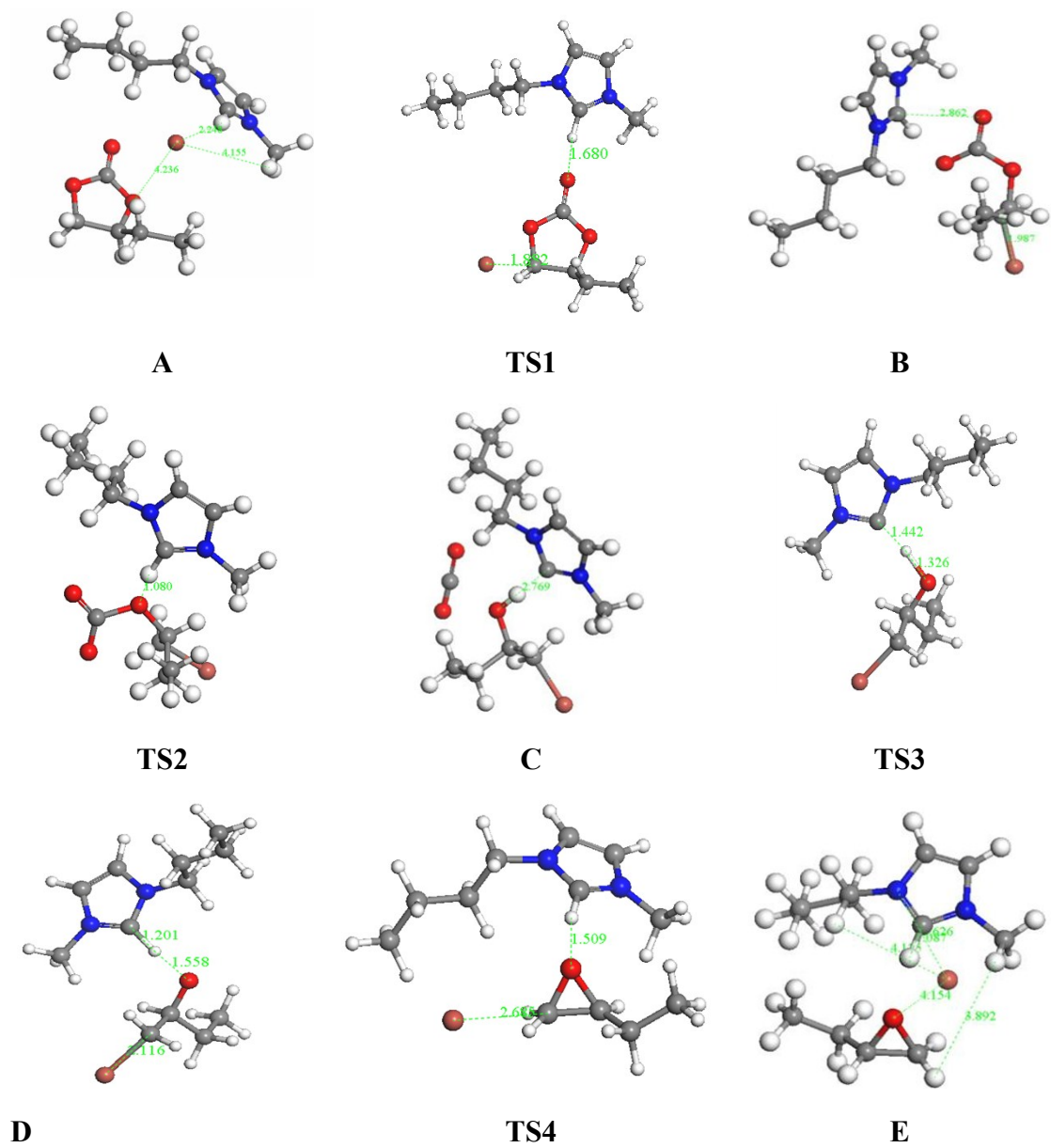


Figure S7 Reaction pathways to produce BO

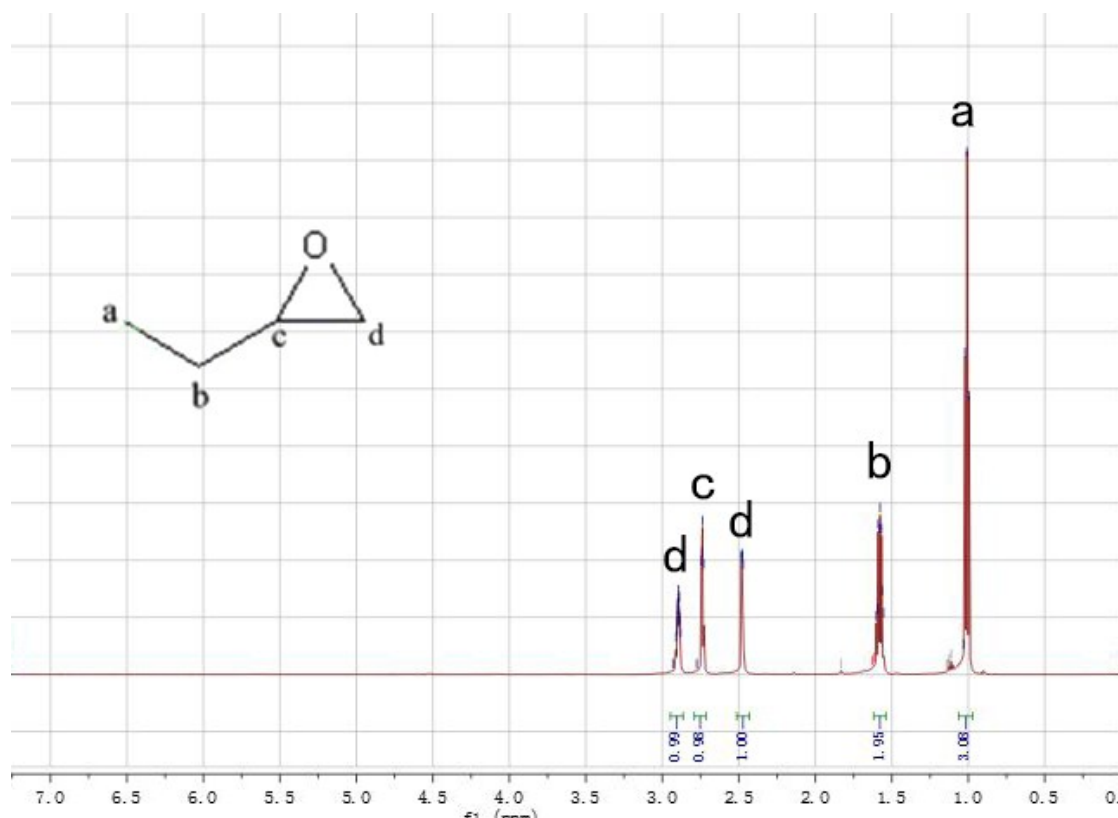


Figure S8 $^1\text{H-NMR}$ spectrum of the BO produced during the decarboxylation reaction.

The structure of BO produced from the consecutive carbonylation and decarboxylation was also determined by $^1\text{H-NMR}$ analysis. As illustrated in Figure S2. There are five characteristic peaks corresponding to different protons in these spectra. The signals at 1.02 ppm was attributed to the methyl protons of BO (CH_3); δ 1.58 ppm was ascribed to the methylene protons of BO (CH_2); δ 2.74 ppm is attributed to the methyne proton of BO (CH); the two singlets at 2.48 and 2.89 ppm are attributed to the protons of BO. The $^1\text{H-NMR}$ results further verified that there are no other impurities in BO. Above all, in this work, the decarboxylation of BC was successfully conducted and remarkable results were achieved over $[\text{Bmim}][\text{Br}]$ catalyst.