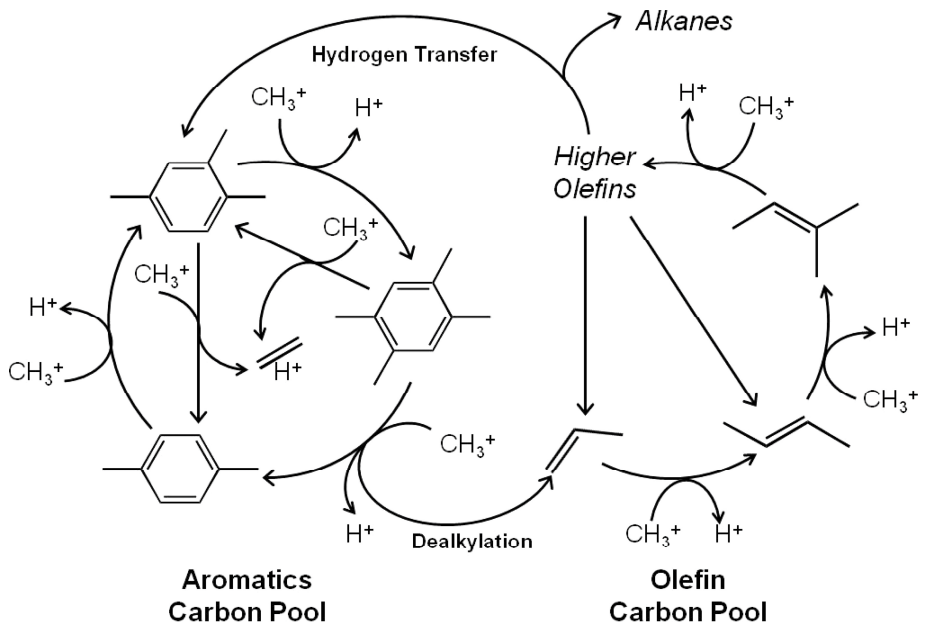

Figure S1. Schematic Diagram of the double cycle mechanism in the stable stage of MTO reaction

The Figure S1 references the dual-cycle diagram as understood by Ilias et al. [1]. This reference corresponds to reference [13] in the main text.

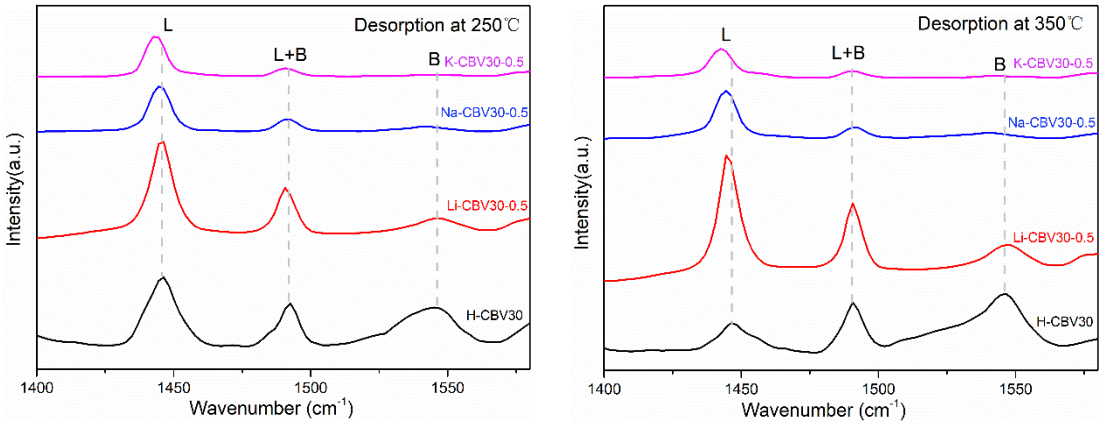

Figure S2. PY-IR spectra of pyridine adsorption at 250 ℃, and 350 ℃(alkali metal solution concentration: 0.5 mol/L).

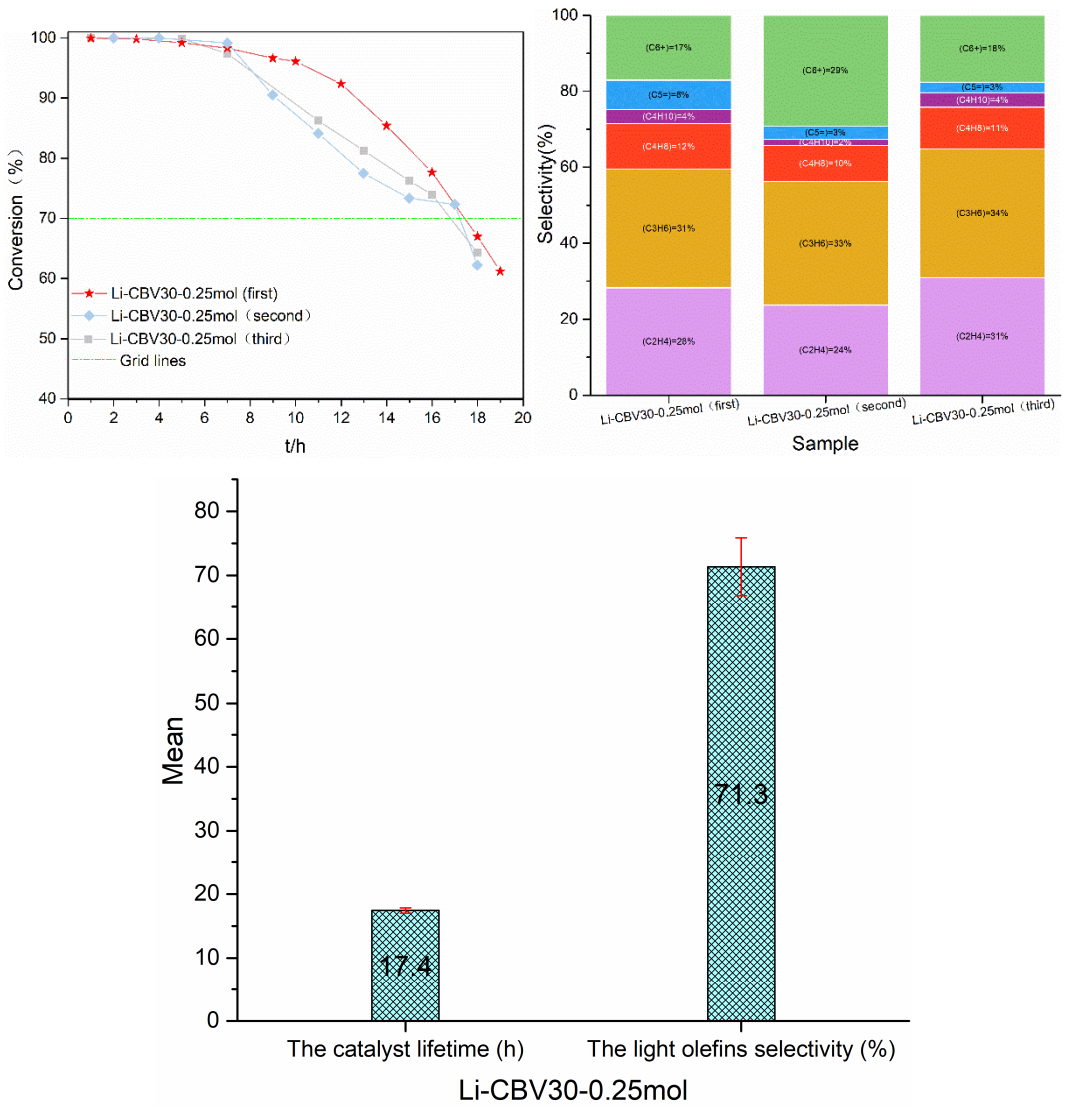

Figure S3. Reproducibility results of the MTO reaction over Li-CBV30-0.25 mol zeolite: (a) methanol conversion; (b) product selectivity; (c) catalytic lifetime and selectivity to light olefins with error bars.

Table S1: PY-IR characterization results

Sample	Py desorption temperature (℃)	Amount of B acid(μmol/g)	Amount of L acid(μmol/g)
H-CBV30	150	431.0732292	360.282474
	250	294.1392188	229.6683594
	350	230.0160417	47.18356771
Li-CBV30	150	146.2970918	346.1956378
	250	122.7922959	243.6531633
	350	95.23494898	145.089949
K-CBV30			
	150	23.62533333	314.4353333
	250	8.961333333	105.222
	350	6.11	51.688
Na-CBV30			
	150	46.13358586	260.5843434
	250	29.6859596	129.0801515
	350	20.05808081	75.75126263

[1] Ilias, S.; Bhan, A. Mechanism of the catalytic conversion of methanol to hydrocarbons. *ACS Catal.* **2013**, *3*, 18–31. https://doi.org/10.1021/cs3006583.