## **Electronic Supplementary Information (ESI)**

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Fig. S1 XRD patterns of detached SAPO-18 shell layers



Fig. S2 SEM image of SAPO-18 (a1,a2,a3) and LSp@0.3S(b1,b2,b2)



Fig. S3 N2 adsorption-desorption isotherms of as-synthesized samples.



Fig. S4 NH3-TPD profiles of Samples LS LSp@0S, LSp@0.15S, LSp@0.3S



**Fig. S5** Selectivity of  $C_2H_4$  (A), Selectivity of  $C_3H_6$  (B), Ratio of  $C_2H_4$  to  $C_3H_6$  (C), Selectivity of  $C_{4+}$  (D) with time-on-time over as-synthesized samples. Reaction conditions: 425 °C, WHSV=1 h<sup>-1</sup>, catalyst weight =500mg.



Fig. S6 Selectivity of SSp@0.15S



**Fig. S7** Hydrogen transfer index ( $C_3H_8/C_3H_6$ ) in the MTO reaction over as-synthesized samples. Experimental conditions: WHSV = 1 h<sup>-1</sup>, T = 425°C, catalyst weight = 500 mg.



Fig. S8 Olefin selectivity and lifetime of sample SSp@0.15S during reactivation cycling.



Fig. S9 TGA curves of the calcinated sample SSp@0.15S in nitrogen atmosphere.