

Facilely sulfolane-modified resins for enhancement of dimethoxymethane carbonylation

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Supplemental files

DA-330 was reused for five times, and the reaction results are exhibited in Fig. S1. For the initial usage, DA-330 displayed 97.20% DMM conversion, as well as 15.10% dimethyl ether (DME), 12.10% methyl formate (MF), 9.00% methanol (MeOH), 1.00% polymethyldimethylether (DMM₂), 58.00% MMAc, and 4.80% methyl glycolate (MG) selectivities. For the second application, DA-330 showed a little higher (98.66%) DMM conversion and much higher (66.20%) MMAc selectivity, which is about 8.20% higher than that of the first usage, and much lower MF (6.21%) and MeOH (4.12%) selectivities, which are about 5.89% and 4.88% declined. For the other times of recycling, the MMAc selectivity all kept above 65.77%.

According to the photographs in Fig. S2, it is obvious that with the increase of

pretreatment temperature, the dense polystyrene construction was further intensely expanded, and more and more resin structure was dissolved, leading to the larger pore diameter and pore volume. The relatively weaker catalytic activity of SA_{resin}-sulfolane-353K is attributed to the low treatment temperature that the swelling and dissolution of resin was slight, leading to relatively less accessible acid sites and smaller swelling holes than that of SA_{resin}-sulfolane-393K.

The effect of consecutive reaction temperature variations from 333 to 433 K with SA_{resin}-393K as the catalyst on vapor-phase carbonylation of DMM is shown in Fig. S4. With gradually increasing the temperature from 333 to 363 K, the MMAc selectivity gradually increased from 72.77% to 88.24% along with about 0.45% MF selectivity and reduced MeOH and MG selectivity changing from 15.21%, and 10.61% to 6.25% and 4.02%, respectively. When the reaction temperature further increased from 373 to 433 K, the DME selectivity gradually increased from 15.97% to 35.60% and the MMAc selectivity slowly decreased from 72.76% to 51.90%. At 363 K, SA_{resin}-393K displayed highest MMAc selectivity (88.24%), which was still about 11.72% lower than that of SA_{resin}-sulfolane-393K. It can be concluded that SA_{resin}-393K exhibited similar products selectivities change rule but much lower MMAc selectivity as compared with those of SA_{resin}-sulfolane-393K in Fig. 7.

Figure caption

Fig. S1. The carbonylation results of DA-330 reused for five times.

Fig. S2. The swelling photographs of the resins untreated/treated by sulfolane at different temperatures (353K, 393K and 413 K).

Fig. S3. The relationship of the content of sulfolane with catalytic activity.

Fig. S4. The relationship between products selectivities and different reaction temperatures on vapor-phase carbonylation of DMM with SA_{resin-393K} as the catalyst.

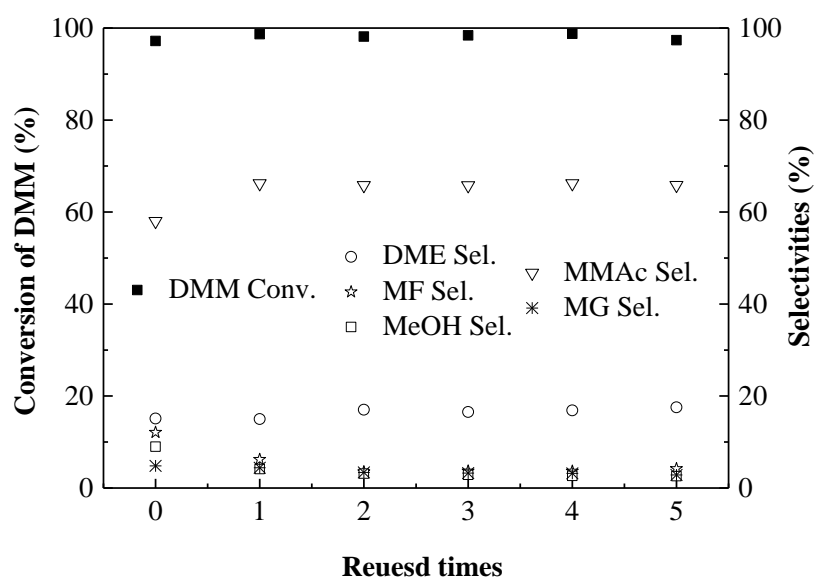


Fig. S1. Yao et al.

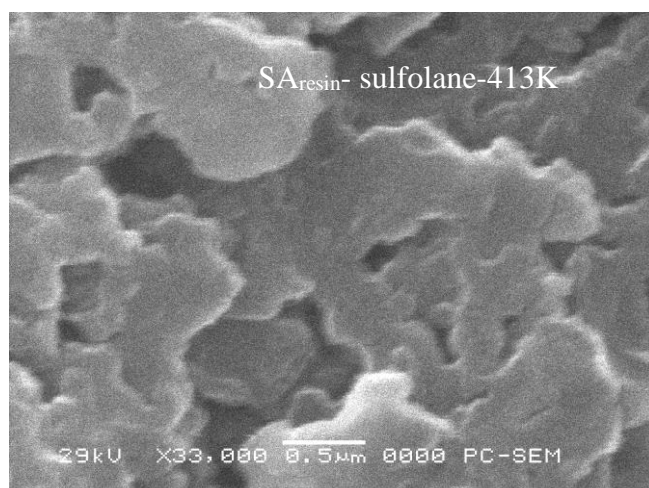
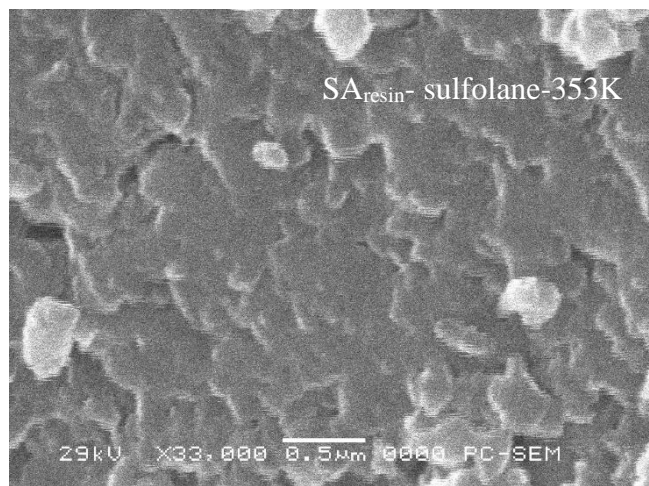
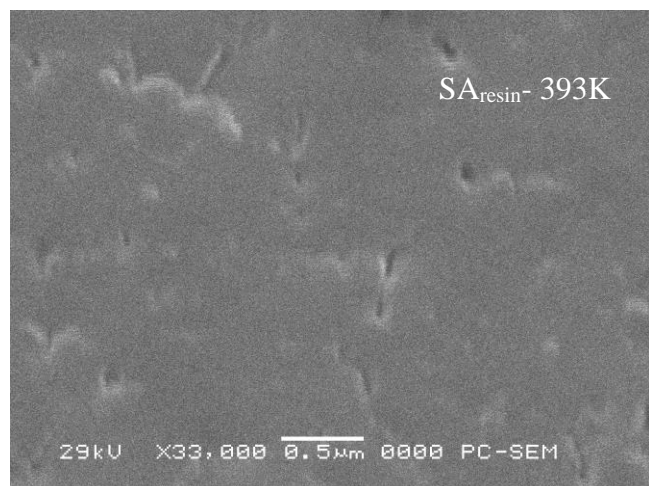


Fig. S2. Yao et al.

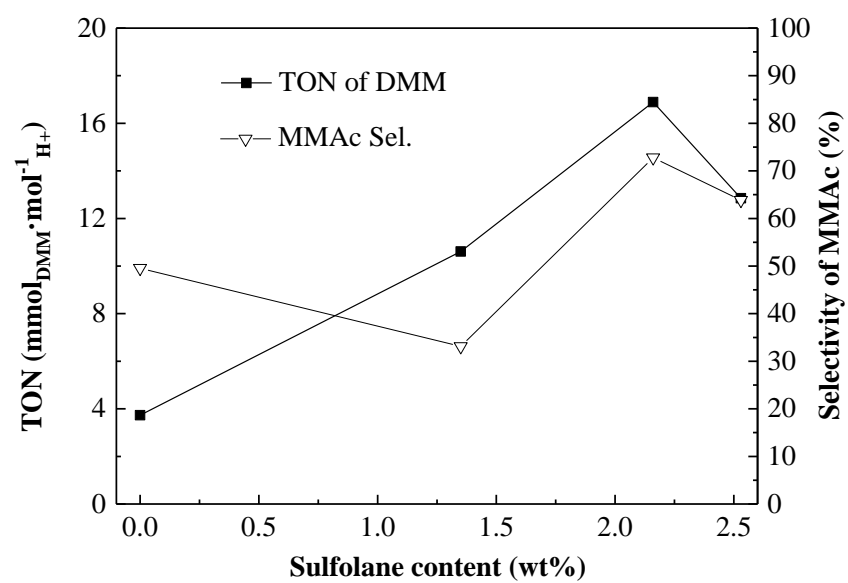


Fig. S3. Yao et al.

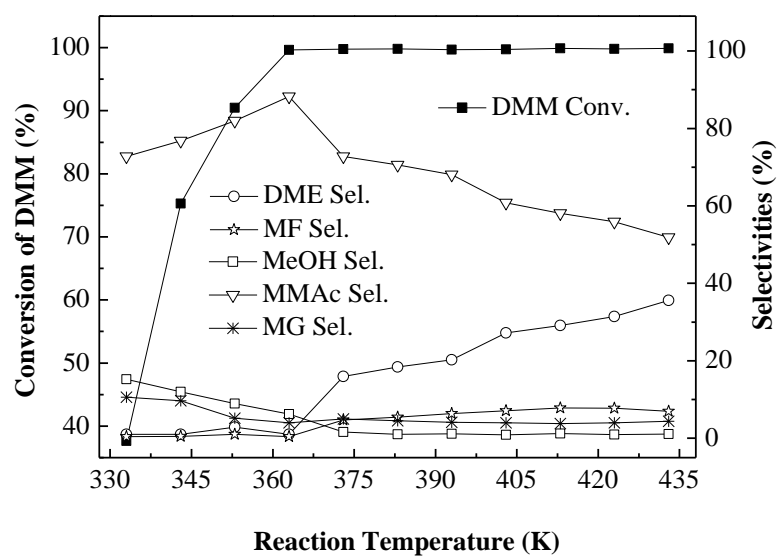


Fig. S4. Yao et al.