

Epoxidation of propylene over Ag/TS-1 using KOH As Precipitator

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Introduction

Propylene oxide (PO) is a valuable intermediate in organic chemistry. There is an increasing market demand for it. Due to the disadvantages of traditional processes of PO [1], extensive efforts are being made to develop an alternative process for direct epoxidation of propylene using molecular oxygen or other oxidizing agent[2-5]. Haruta and co-workers[5] first announced the discovery of a titania-supported gold catalyst that gave an epoxidation selectivity above 90%. In our group, Ag/TS-1 was reported to be a good catalyst for gas-phase epoxidation of propylene, and found that K_2CO_3 is a suitable precipitator. As well as the Au catalyzed gas-phase epoxidation process does, low conversion of propene and rapid catalyst deactivation are major problems of Ag/TS-1 system. Aiming to find a valid Ag/TS-1 catalyst with high activity and stability, the effect of precipitator and the crystallization time of TS-1 on the catalytic performance of Ag/TS-1 were investigated.

Experimental

TS-1 was synthesized by using TPABr as the template and butylamine as the base, respectively, according to literature[6]. The crystallization time of TS-1(A) is 67 h, and that of TS-1(B) is 120 h. Gas-phase epoxidation of propylene was carried out in a fixed bed, quartz down-flow reactor of 8 mm inner diameter using 0.5 g Ag/TS-1. The typical reaction conditions were as follows: $VC_3H_6 : VO_2 : VH_2 : VN_2 = 1 : 3 : 3 : 12$, WHSV 4000 h^{-1} . The activity of the catalyst was calculated on the basis of the carbon balance.

Results and Discussion

Fig1. shows the results of epoxidation of propylene over Ag/TS-1 catalyst prepared by using K_2CO_3 , NaOH and KOH as the precipitator. It's clear that the performance of Ag/TS-1 catalyst

prepared by KOH is more stable than that by K_2CO_3 and NaOH, propylene conversion remains above 1% after 350 minute reaction. When TS-1 (A) is replaced by TS-1 (B) to prepare Ag/TS-1 catalyst, the conversion of propylene reaches 2.9% after 30 minute reaction, and PO selectivity is about 100%.

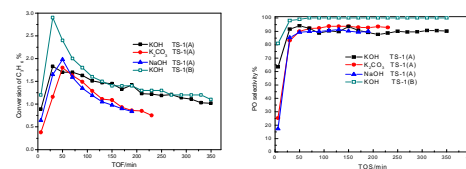


Fig 1. Effect of precipitator on the gas-phase epoxidation of propylene over Ag/TS-1

Conclusion

In summary, Ag/TS-1 catalyst with high activity and stability in the gas-phase epoxidation of propylene was prepared by adjusting precipitator and crystallization time of TS-1, the conversion of propylene is 2.9% and the selectivity to PO is 100%, and after 350 min reaction, the conversion of propylene remains above 1%.

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