Influence of the support of europium supported catalysts in ethylene oxychlorination

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The industrial manufacture of vinyl chloride relies on a two-step process involving $CuCl_2$ catalyzed ethylene oxychloriantion to ethylene followed by thermal cracking of the latter to vinyl chloride. According to a recent study, a one-step reaction from ethylene to VCM occurs on a europium oxide catalyst, and high VCM selectivity can be obtained. However, it is difficult to use it as ethylene oxychlorination catalyst due to low reaction activity, high europium price, and loss of europium in the catalyst manufacturing process. Therefore, various kinds of support are introduced into the catalyst. The supported Eu_2O_3 catalysts showed high activity and VCM selectivity. H_2-TPR, NH_3-TPD, C_2H_4-TPD, EDC dehydrochlorination tests unravel the influence of Eu-support interaction which affects redox property, acid property, and adsorption energy of reactant and product. Among the supported catalysts, Eu_2O_3/Y-60 exhibited the highest ethylene conversion (18 %) and VCM selectivity (90 %) but catalyst deactivation caused by coke deposition was observed. Eu_2O_3/Al_2O_3 exhibited second highest ethylene conversion (15 %) and VCM selectivity (81 %) and the reaction activity was stably maintained.