Selective catalytic oxidation of Hydrogen Sulfide Using Niobium Oxide Supported on Iron-Pillared Montmorillonite clay catalyst

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In purification of natural gas and crude oil plants and the steel smelting process lead to huge amounts of highly poisonous hydrogen sulfide (H_2S). For few decades, most of H_2S in oil refineries and smelt plants has been removed by converting it into elemental sulfur using the Claus process. However, the separation of H_2S from the solution is not perfect, hence the 3-5 % H_2S remained which causes SO_X emission problem during the incineration. One attractive solution is the selective catalytic oxidation of H_2S to ammonium thiosulfate (ATS) and elemental sulfur. In this study, we examined performance of the niobium oxide supported on iron-pillared Montmorillonite clay (Nb/Fe-PILC) catalysts for the selective oxidation of H_2S. The synthesized catalysts were analyzed by XRD, BET, ICP, NH_3-TPD, H_2-TPR and XPS. 3wt. % Nb_2O_5/Fe-PILC showed the highest H_2S conversion among all the catalysts tested. It exhibited over 95% H_2S conversion without any significant emission of sulfur dioxide at 220 - 300℃. For the better effective understanding of reaction mechanism, the distribution of production of products (S and ATS) was also discussed.