

Synthesis of Ziegler-Natta/Metallocene Hybrid Catalysts: Investigation of the effect of different parameters on the amount of Metallocene loading using Response Surface Method

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Abstract

A series of hybrid catalyst was made through mixing of 4th generation Ziegler-Natta and Bis(2-phInd)ZrCl₂ Metallocene catalysts using TEA as the coupling agent. Response surface methodology (RSM) based on a three-level, three-variable Box-Behnken design was used to evaluate the interactive effects of different parameters such as amount of Metallocene catalyst, mmol TEA and temperature on the amount of metallocene loading. The concentration of each loaded elements including Al and Zr was characterized using ICP-OES and EDXA. It was found that temperature plays a very important role on loading of the metallocene catalyst while TEA had less determining effect. After each treatment of ZN catalyst (with TEA or Metallocene) the catalyst morphologies were checked by microscopy to ensure that the shape of the catalyst was retained. BET analysis of the ZN catalysts before and after the treatments showed that upon reacting the catalyst with TEA its specific surface area comes down considerably showing some kind of blocking of the pores of the catalysts. Bulk analysis of the hybrid catalysts through ICP analysis showed that as the concentration of Al went up in the catalyst the concentration of Zr passed a maximum while surface analysis of them through EDXA showed that as the Al concentration went up, Zr concentration also went up in a direct relationship.

Key words: Hybrid catalysts, Ziegler-Natta, Metallocene, Surface analysis, Bulk analysis