Development of the Next Generation Vinyl Acetate Monomer Catalyst

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Introduction

Vinyl acetate monomer (VAM) is an important chemical intermediate used in manufacturing of coatings, adhesives and textiles. The major route to production of VAM is through the reaction of ethylene with oxygen and acetic acid over a bimetallic palladium-gold catalyst. A worldwide annual demand of over four million metric tons of monomer represents consumption of significant quantities of catalyst and a demand for continuous improvements in catalytst performance.

Developed in the 1970's, acetoxylation of ethylene has replaced older Reppe acetylene-based technology in much of the world. The oxidation reaction is generally performed in fixed-bed multi-tubular reactors using a supported catalyst. The three component reaction with ethylene, oxygen and acetic acid to produce VAM is exothermic but the exotherm from undesired oxidation of ethylene to carbon dioxide reduces both yield and limits productivity due to reactor heat exchange.

Catalysts improvements since the mid-1970's include an egg shell coating of metals to improve selectivity with a shorter diffusion path. However, there is a trade-off between metal concentration, the thickness of the coating, and metal dispersion. Higher reactor productivity can be achieved with higher metal loading but at a sacrifice of selectivity.

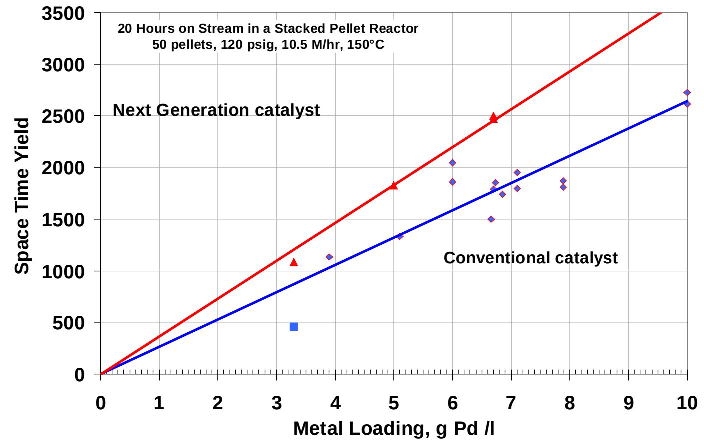
BASF has been able to develop more active and selective catalysts at lower metal loading allowing for optimization of the metal coating and overall improved performance. This presentation highlights key features of BASF's proprietary VAM catalyst technology while providing an update on the new developments that promise to deliver superior performance to our existing commercial offerings.

Materials and Methods

Key to development of improved catalysts has been the development of meaningful performance tests. Since the introduction of ethylene acetoxylation, BASF developed both integral and differential test reactor designs. A stacked-pellet differential reactor design, with a high heat transfer rate, allows for measurement of catalyst activity and selectivity under well controlled conditions. Using these tools, key catalyst parameters have been identified and improved catalysts have been developed.

Results and Discussion

A new catalyst with higher activity at equal metal loading developed and shown in the figure below. The catalyst features improved activity (measured as Space-Time-Yield) and selectivity at equal metal loading.



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