JM

Managing pressure drop across the reforming section

Ammonia production efficiency is greatly impacted by the pressure losses across the flow sheet. One of the key energy inputs is achieving the pressures necessary for the Haber-Bosch reaction to occur. Loss of pressure through the system, called pressure drop, has two key aspects, the fixed pressure drop at start of run and pressure drop growth over time. Fixed pressure drop across the flow sheet is a key design consideration and is easily calculated but it is the variable pressure drop growth over time that causes unforeseen efficiency losses across a plant life cycle. Pressure drop impacts your plant efficiency, production rates, and profitability.
By selecting a catalyst specifically designed to reduce the impact of both fixed and variable pressure drop, higher efficiencies can be achieved for longer time online – to achieve these goals Johnson Matthey (JM) supplies performance KATALCO™ products.

Increased compression demand	HP steam demand goes up – can impact efficiency
Ammonia production decreases	Syngas compressor becomes maxed out and ammonia loop pressure decreases
Upstream relief valves	Increasing upstream pressure limited by RV set point
Tube metal life decrease	Higher pressure at fixed temperature decreases tube life expectancy

Figure 1 - Consequences of pressure drop

Figure 2 shows the pressure drop across a nominal ammonia plant. It can be seen that the largest single contributor to the overall pressure drop in an ammonia facility is the primary reformer. Managing pressure drop therefore relies heavily on the performance of dependable and durable primary reforming catalysts.

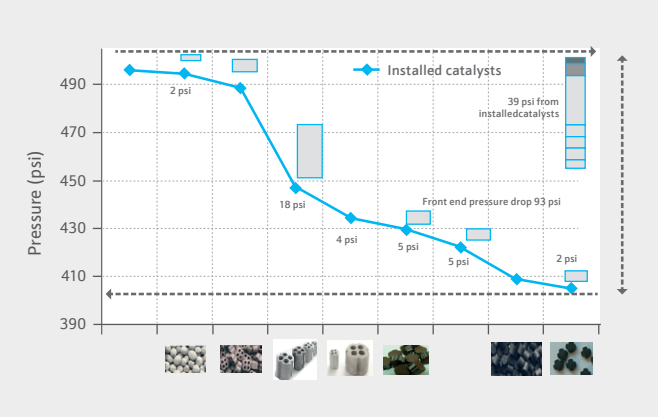

Figure 2 - Pressure drop contributions across the ammonia production process

Over the past 60 years, primary reformer tube diameters have doubled with the development of alloys. Tube diameters today are much thinner, making the design of catalyst loadings crucial to limit the maximum tube wall temperature. Bigger pellets can be utilized with larger tubes to achieve lower pressure drop (Figure 3); however, larger pellets must still retain suitable breakage and heat transfer characteristics.

Figure 3 - JM QUADRALOBE catalysts

KATALCO products work reliably and profitably due to their unique shape which provides maximum geometric surface area, allowing for enhanced activity and low pressure drop; the **QUADRALOBE**™ catalyst pellet shape breakage characteristics mitigates pressure drop increases related to thermal cycling; and a range of sizes is available to maximize customer operating goals.

KATALCO QUADRALOBE catalysts have been designed to reduce pressure drop growth through their unique sizes and shapes. **KATALCO QUADRALOBE** pellets range in size from the large **KATALCO XQ QUADRALOBE**, which offers the lowest pressure drop, to the smallest, **KATALCO MQ QUADRALOBE**, which offers the highest activity (Figure 4). Larger sizes correlate to lower pressure drop, but pellet strength and breakage characteristics are also important considerations to dP growth.

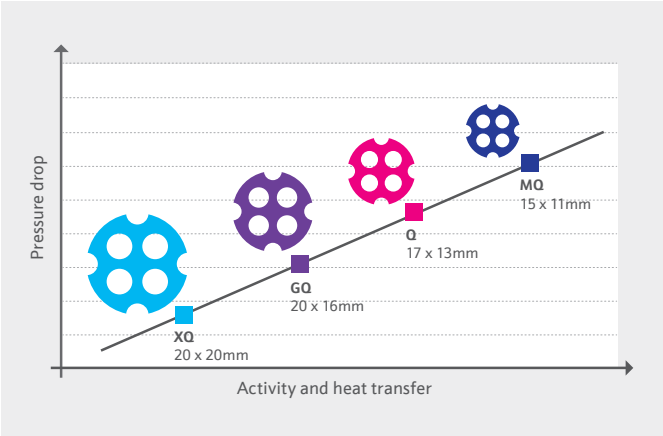

Figure 4 - Range of QUADRALOBE catalysts

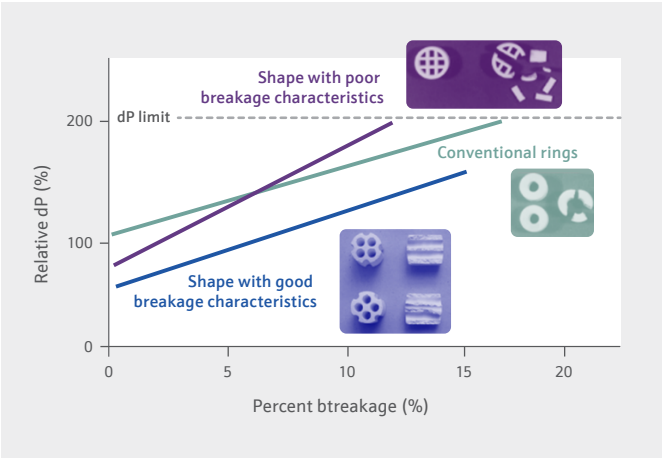

Figure 5 - Breakage characteristics and dP.

As the tubes expand and contract, the catalyst will be subjected to stresses and crushing. To anticipate these inevitable breakages, JM **QUADRALOBE** catalysts have been designed to break in half or into large pieces, minimizing small particulates and maintaining a low dP growth over time (Figure 4).

Johnson Matthey's experience in reformer modelling and monitoring allow the benefits of larger pellets to be evaluated, meaning that reformers with **KATALCO** loadings can operate with lower pressure drop and therefore reduced operating costs.

Talk to JM today to find out how we can provide catalysts and technology to help you get the most out of your operations.

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