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Johnson Matthey
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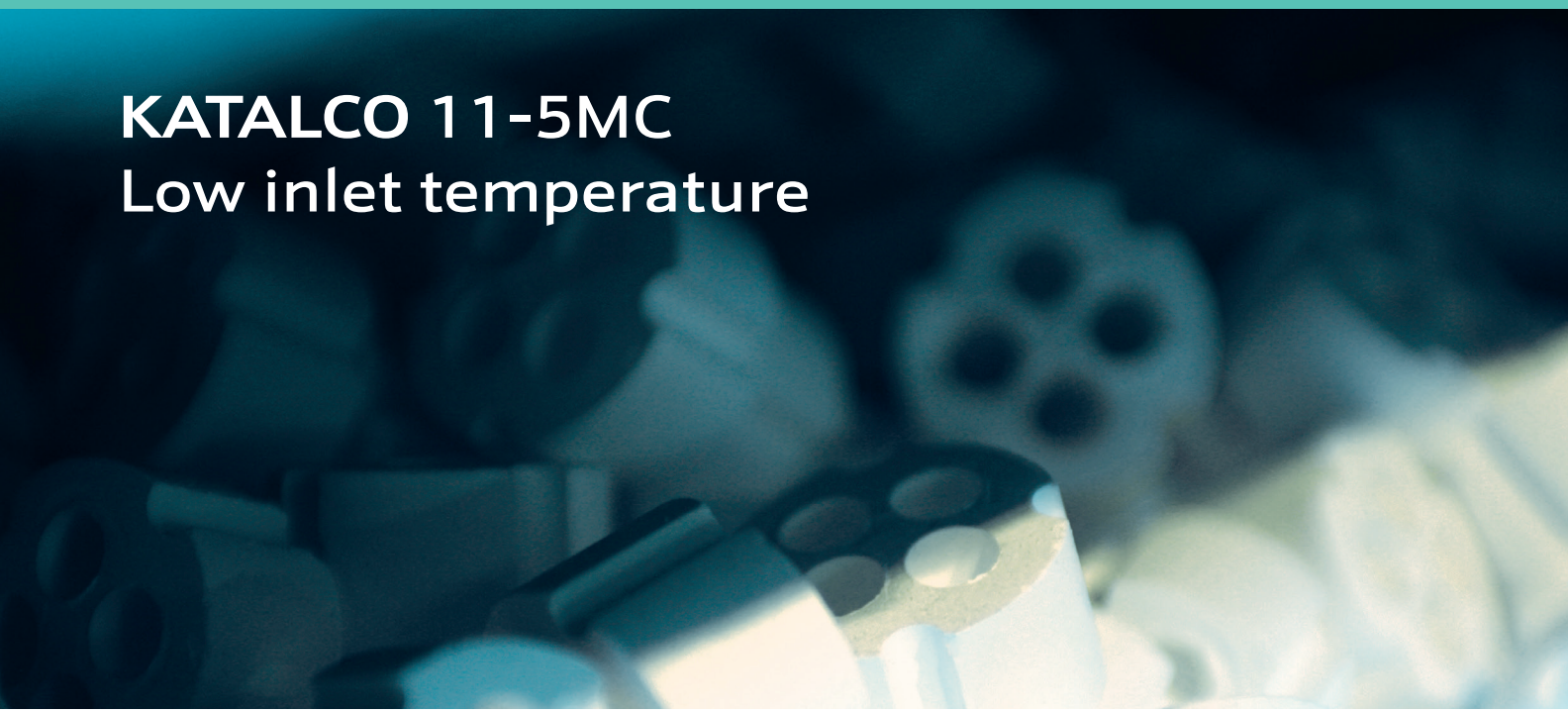
Case Study



KATALCO 11-5MC
Low inlet temperature

KATALCO 11-5MC is Johnson Matthey's latest development in the 11-series methanation catalysts product line. This product features an optimized shape, a micro cloverleaf, instead of the traditional pellet that was utilized by its predecessors. This shape allows for a higher surface area, and thus enhanced methanation activity. As a result, **KATALCO** 11-5MC is a highly active catalyst at much lower inlet temperatures than competitor products.

A North American refinery has experienced mixed results with their methanation catalysts. Johnson Matthey previously had a charge of **KATALCO** 11-3 that performed for 15 years from 1985 until 2000. In October 2000, Competitor A material was installed and performed until May 2011. In the 2011 turnaround, Competitor B material was installed and was online until March 2016. For the 2016 turnaround, **KATALCO** 11-5MCR and 11-4R were installed. Prior to the loading of the ordered **KATALCO** 11-5MCR and 11-4R, a weld was made on the methanator vessel that was determined to be of the incorrect metallurgy. As a result of this weld, the maximum operating temperature of the methanator vessel is limited, so the inlet temperature has been minimized.

Data that has been collected from the North American refinery since 2000 shows that the current Johnson Matthey charge has experienced much lower inlet temperatures than either of the two competitor charges. Despite the low inlet temperature, **KATALCO** 11-5MCR and 11-4R are showing strong catalytic activity, as no carbon oxides slip has been observed. The high activity can be observed in Table 1, which shows a higher temperature

rise across the methanator bed from Johnson Matthey's catalyst compared to the two competitors. Figure 1 shows a visual representation of the inlet temperatures throughout these three charges, for which Johnson Matthey is approximately 50°F lower on average.

When comparing the life of the three competitor charges, the Competitor A charge performed for almost 11 years, while the Competitor B charge was less than 5. Johnson Matthey methanation catalysts have consistently shown greater than 11 year lives; however, the low inlet temperature places additional stress on the catalyst. A z90 plot, which analyzes the movement of the reaction down the catalyst bed, has been generated in Figure 2 for the three methanation catalyst charges. The z90 plot can be used to anticipate the catalyst time online based on its predicted changeout. It is expected that the **KATALCO** 11-5MCR / 11-4R charge will exceed the life of the Competitor B charge, which reached end of run after 4.8 years online. The z90 trend for the Johnson Matthey catalyst charge seems nearly parallel to the Competitor A charge, which is impressive considering the difference in inlet temperature.

Catalyst	Time analyzed (Years)	Average inlet temperature (°F)	Average temperature rise (°F)
Competitor A	3.2	462	48
Competitor B	2.3	474	44
KATALCO 11-5MCR /11-4R	1.2	418	73

Table 1: Average methanator inlet temperature and temperature rise

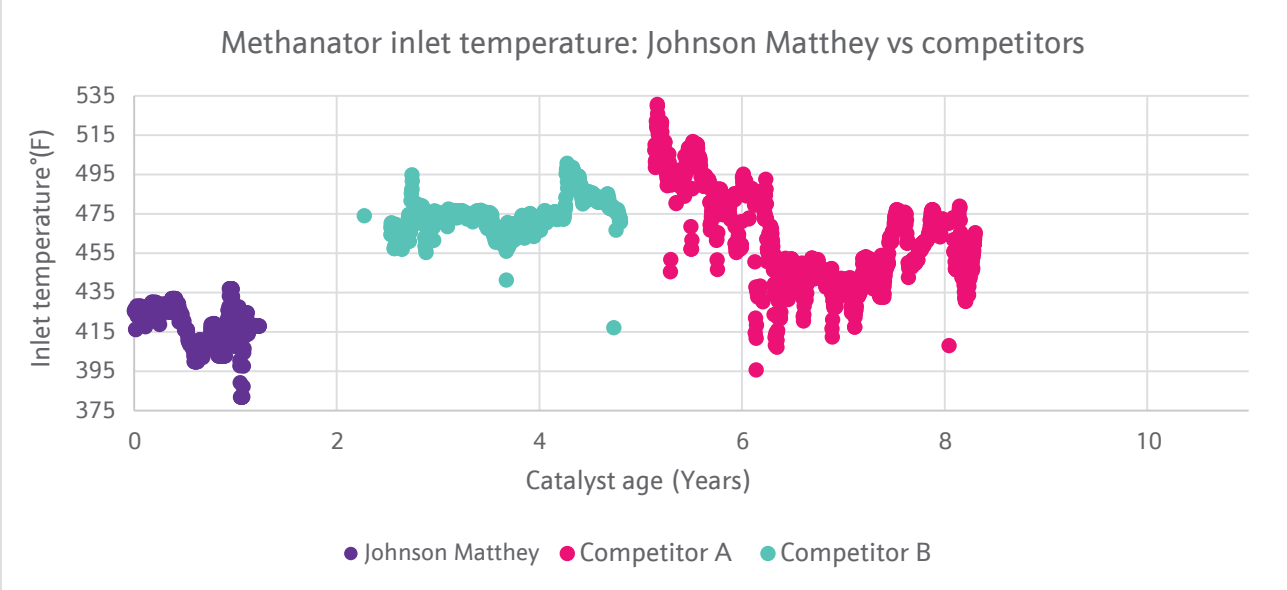


Figure 1: Inlet temperatures of methanation charges

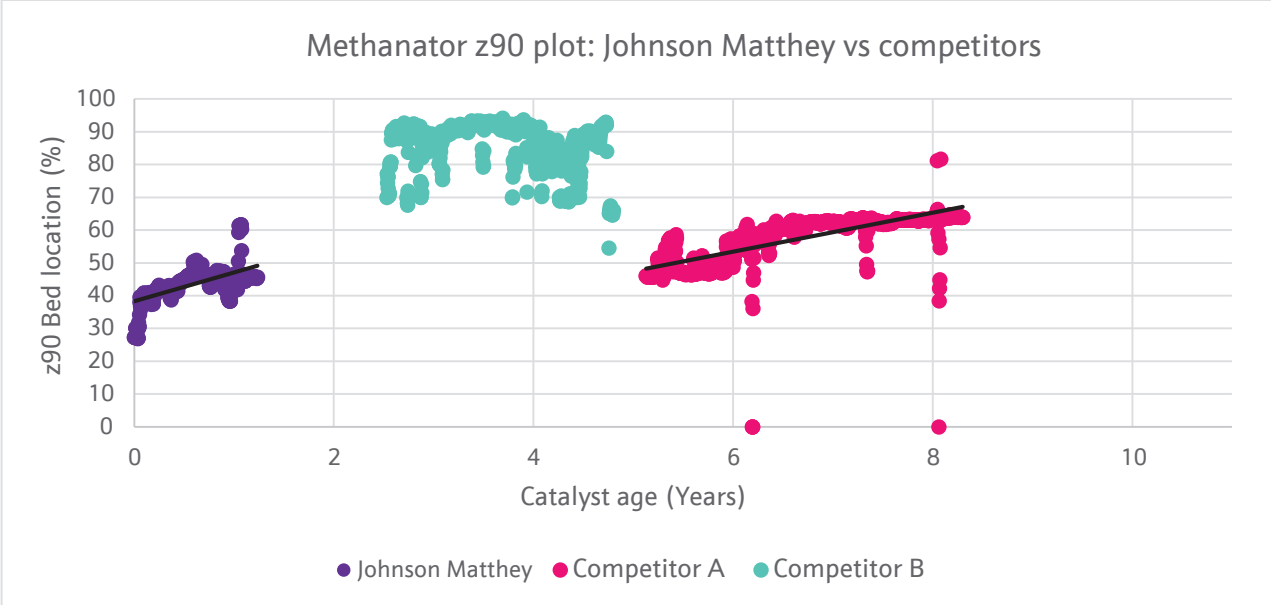


Figure 2: z90 plot of methanation charges

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