Air Products-Entrained Particle Flow Test Rig
Construction and Operation

Overview
Combustion flue gas is often treated using selective catalyst reduction (SCR) to remove NO\textsubscript{x} emissions. Under certain conditions solid particles contained in the flue gas are causing catalyst plugging.

Objectives
Air Products requested that a test rig be constructed to entrain particles in a flowing ambient air stream and passed through four sample catalyst blocks. Two different pitch sizes from two manufacturers were evaluated. These tests were used in an effort to simulate the hydrogen reforming facilities and aid Air Products in understanding the plugging problem.

Approach
- The team began the project by developing an appropriate list of customer needs that the team would attempt to fulfill for our customer, Air Products.
- Each team member developed a concept for a test rig design.
- A new concept was created during the concept selection process by combining certain aspects of each team member’s concept into one integrated design.
- Air Products provided a significant amount of feedback, and helped the team to continually improve the design and testing process.
- The team generated a final CAD model shown on the bottom right of this page.
- A prototype was required because the project focus was testing catalyst blocks with entrained particulate.
- Significant testing of each catalyst block was performed in the learning factory’s paint booth.
- The team considered other testing options including altering the flow path by inducing turbulence in the flow chamber.
- The testing generated data based on mass introduced and compared it to changes in the pressure drop across the catalyst.
- The team were able to generate graphs of identical flow scenarios for each catalyst, and compare these graphs to determine how each catalyst performed.

Outcomes
- The project provided the sponsor with relevant data comparing the catalysts performance.
- Air Products has requested possession of the test rig after completion of the project, so further testing can be performed.
- The project showed that induced turbulent flow significantly reduced the amount of mass trapped on the front face of the catalyst samples.