FEROX

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Theoretical Effects of Ferox in Turbine Power Plants

Ferox is a combustion catalyst that reduces the energy of activation required to initiate combustion in hydrocarbon fuels. The fuel specifications and energy content of Ferox treated fuel remains unchanged. The ideal products of hydrocarbon combustion in an oxygen environment are CO_2, H_2O, and heat. What Ferox does is allow the fuel to burn more completely during the combustion phase thus reducing the amount of unburned or half burned fuel components present in the exhaust phase where most of the undesired emissions are produced. The partially burned hydrocarbons form carbon deposits on the combustion and exhaust surfaces of the engine. These carbon coatings are catalytic and trigger the conversion of CO_2 into CO.

In a turbine engine it is primarily the expansion of CO_2 that provides the thrust. The catalytic conversion of CO_2 back to CO robs the engine of thrust while generating excess oxygen that contributes to the formation of NO_X and SO_X compounds. Ferox reduces or eliminates carbon deposits on the combustion and exhaust surfaces through complete combustion of the fuel in the combustion chamber. More complete combustion produces a greater amount of CO_2 allowing the engine to produce more thrust per unit of fuel burned.

There are 3 primary factors required for the production of emissions in turbine exhaust. They are excess oxygen, high temperatures, and dwell time. With more of the fuel burning in the combustion chamber instead of outside in the exhaust phase, oxygen is consumed and used in the production of CO_2 where it is most useful. This more efficient consumption of fuel also removes an extended source of heat from the exhaust environment. These factors reduce the prime conditions of temperature and dwell time under which nitrogen and sulfur produce NO_X and SO_X. This removal of extended heat generation also allows bypass air to cool the exhaust more effectively. The temperature gradient of the exhaust will shorten slightly.

Unburned hydrocarbons form soot and smoke in the exhaust. This contributes to PM-10. Nitrogen in an extended hot environment with free oxygen for long periods of time will produce NO_X. NO_X leads to the production of PM-2.5.

When first introducing Ferox treated fuel to an older turbine engine an increase in CO, NO_X and soot may be noticed. This is normal. As the Ferox catalyst works on existing deposits they are loosened up and burned off. As these deposit particles are removed they can still act as a catalyst to convert CO_2 to CO and O_2. As they burn they also contribute additional heat downstream of the combustion chamber in the exhaust. The additional heat and excess oxygen provide extended prime conditions for the production of NO_X. Once the engine surfaces are free of deposits these emissions will drop dramatically. Testing will help determine how fast the deposits are removed from an operating turbine engine and how quickly the the emissions will stabilize. When using Ferox in a clean engine these emissions will stay low and remain that way for the life of the engine.

Although the percentage of CO_2 will rise slightly per unit of fuel burned due to its more efficient combustion the overall amount of CO_2 produced will be less due to improved fuel consumption.