



Catalyst Testing Services

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MEGTEC does three tests on routine catalyst samples. These are:

1. Activity
2. Surface Area
3. Contaminants

The Catalyst Activity test is a measure of the catalysts' ability to convert hydrocarbons to carbon dioxide and water. The conversion efficiencies obtained in the lab do not predict those to be seen in the pollution control unit. However, a catalyst that performs well by lab standards will perform well in a unit, provided the unit is mechanically sound.

Catalyst activity is often related to the amount of active surface exposed to the air stream so a surface area evaluation can be meaningful. If a catalyst does not show adequate activity, often the surface area can give insight into the problem. The Activity and Surface Area tests are done at MTS. The contaminant scan, called an ICP Analysis (Inductively Coupled Plasma), is performed by an outside laboratory.

Catalyst Activity

The lab tests consist of passing a stream of solvent laden air through a small vessel that holds the sample. The flow is controlled such that the sample is exposed to a space velocity typical of a MTS catalytic pollution control unit (12000 GHSV). The flow stream used is a 625 ppm Hexane/air mixture that corresponds to a 6% LFL concentration. The sample (reactor) is first heated in an oven and allowed to equilibrate at the setpoint temperature. The sample's conversion efficiency is then evaluated by measuring the hydrocarbon concentration in the stream before and after the catalyst by FID. The FID does not detect that portion of the solvent that was cleaned-up (converted) in a catalytic reaction.

Surface Area

The surface area measured is the microscopic surface area of the catalyst. The procedure used is known as the BET (Brunaur, Emmett and Teller) single point determination. The surface area of a sample is determined by adsorbing a gas from a mixture of adsorbable and non-adsorbable carrier gas. The process of adsorption and desorption is monitored by measuring the change in the thermal conductivity of the gas mixture. The mixture used for catalyst testing is 30% nitrogen in helium.



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Adsorption is started by immersing the sample contained in a glass cell into a liquid nitrogen bath. A measurement is obtained on the adsorption peak that is produced by the change in thermal conductivity of the gas mixture leaving the cell. Adsorption is complete when there is no longer any difference in the thermal conductivity's of the gas entering and leaving the sample cell.

Desorption is achieved by removing the cell from the liquid nitrogen bath. The nitrogen previously adsorbed on the catalyst surface is now released into the gas stream. This produces a change in thermal conductivity that is once again measured as a peak.

A known volume of nitrogen is then injected before the detector to give a calibration peak. The two peak values are compared and the surface area of the catalyst is then calculated.

Contaminants

Levels of contaminants that may affect catalyst performance levels are determined by Inductively Coupled Plasma (ICP)*. This is an elemental analysis, which means it determines which elements are present in what concentrations, but not how they are compounded together.

ICP is an extremely sensitive analytical technique with excellent detection limits. An Inductively Coupled Plasma is created using a radio frequency coil to turn a stream of argon gas into a high-energy plasma. When a sample is aspirated into this plasma, it generates ions. An emission spectrometer is then used to look optically at the plasma/ions to quantify elements present in the aspirated sample. ICP emission spectrometers have detection limits in the ppm to ppb range, depending on the element.

*Proton Inducted X-Ray Emission (PIXE) was the contamination analysis of choice for MTS up until May of 2000. At that time it was determined that ICP analysis is more accurate for determining silicon and phosphorus levels. PIXE analysis has notable interferences in the range that measures silicon and phosphorus, which results in poor detection limits.

For further information, availability, please contact your nearest MEGTEC office by visiting www.megtec.com and click on parts and upgrades or email to info@megtec.com.