Maintaining the lifetime of Catalytic Isomerisation Processes through Impedance Moisture Transmitter Measurement in Feedstock

Application Background

In many petrochemical processes the presence of moisture has serious detrimental effects on plant operation and production efficiency. The operation of catalytic processes often relies on trace moisture levels being continuously controlled below a strict threshold to optimise the required conversion process and to avoid costly poisoning of the catalyst bed. In many reactor processes the presence of excessive moisture in hydrocarbon feedstock gives rise to unwanted reactions such as acid formation. Presence of moisture in solvents used in polymer production results in adverse changes in fluid viscosity and drying times. In liquid fuels such as diesel, kerosene and LPG, the presence of moisture is an undesirable contaminant that can separate out to form liquid water if not restricted to low concentrations. Excessive moisture in fuels may also freeze in cold climates to form ice that may lead to fuel supply starvation to the engine, or even complete line blockage. In these, and a multitude of other applications, the failure to conform to set moisture limits is often very expensive in terms of lost productivity and unnecessary maintenance costs. Effective on-line moisture in liquid measurement enables process operators to avoid such problems.

There are a number of processes which use a fixed bed of catalyst, isomerising C5 and C6 paraffins to higher octane branched compounds. The process is key to the efficient production of gasoline fuel. Light naptha isomerate is considered an ideal gasoline blending component due to its high octane and low concentration of undesirable sulphur, olefin and benzene components.

In order to ensure the desired reactions within the catalyst bed and to maximize the lifetime of the catalyst it is critical to strictly control moisture levels within the feedstock. Increased moisture to greater than 1 ppm_W (parts per million by weight) promotes gradual and irreversible deactivation of the platinum coated chloride alumina catalyst bed. This is due to the reaction of chloride alumina with moisture to yield HCl and hydroxylation of the catalyst. For this reason the light naphtha feedstock should be dried to less than 0.1 ppm_W through twin switched column molecular sieve dryers.

Measurement Technique

The Michell Instruments' Liquidew I.S. Moisture in Liquid Analyzer is ideal for continuous on-line monitoring of the moisture content in the C5/C6 feedstock entering the isomerisation process. The measurements taken can confirm that the required trace moisture level is being achieved and also enable the plant operation personnel to judge the optimum timing for drying column changeover in the regeneration sequence. Any degradation in the performance of an individual dryer column can be detected as the columns sequence, enabling any necessary maintenance or desiccant replacement to be scheduled prior to a critical failure situation that could jeopardize the lifetime of the catalyst bed.

Alternatively, where the measurement equipment must be located in a hazardous area, the Liquidew EExd Moisture in Liquid Analyzer is available, ensuring safety in such an environment.

Liquidew EExd

Each of the reactors contains 25,000 Kg of catalyst of which the active element is platinum. The presence of moisture permanently poisons the catalyst. Approximately 100 Kg of catalyst is destroyed for each 1 Kg of moisture or any other source of oxygen within the process. Hence maintaining an extremely low trace moisture concentration is essential to the operation of these processes.

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