



Porous metal filters prevent fluid bed catalyst loss

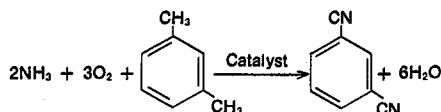
Expensive vanadium catalyst retained in fluid bed;
no other particulate collection required

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Porous metal filters are the only devices required to provide high retention of catalyst solids in two high temperature fluidized beds at Diamond Shamrock's Greens Bayou site. Operating at over 750°F, the reactor and re-oxidizer fluid beds contain a vanadium catalyst that is too costly to lose by elutriation. The porous metal filters not only retain the catalyst within the fluid beds, but, since optimization of the filter metallurgy, do so with a minimum of downtime for cleaning and maintenance.

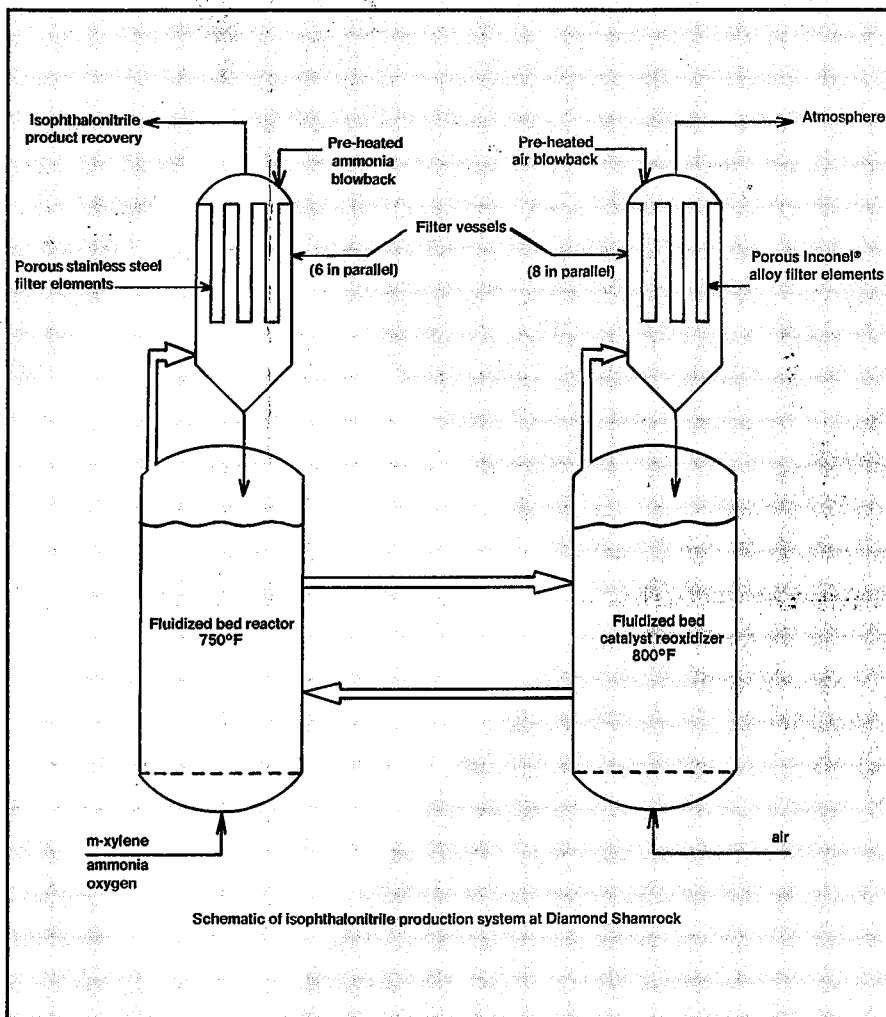
In 1976, Diamond Shamrock began operation of a unit to produce isophthalonitrile, an intermediate in the production of herbicides and fungicides. Using the basic chemical reaction



Diamond Shamrock chose a proprietary aromatic nitrile process technology that had not previously been applied commercially. The process uses a vanadium catalyst in a fluid bed reactor operating at 750°F, with catalyst being continuously reoxidized in an adjacent re-oxidizer fluid bed.

Minimizing loss of the expensive vanadium catalyst was essential to the economic viability of the project. Catalyst loss could also cause other difficulties. Elutriation from the reactor could enter the downstream product recovery system, causing operating problems, and losses from the re-oxidizer could be emitted to the atmosphere, causing environmental problems.

Conventional cyclones normally used to retain solids in high temperature fluid-



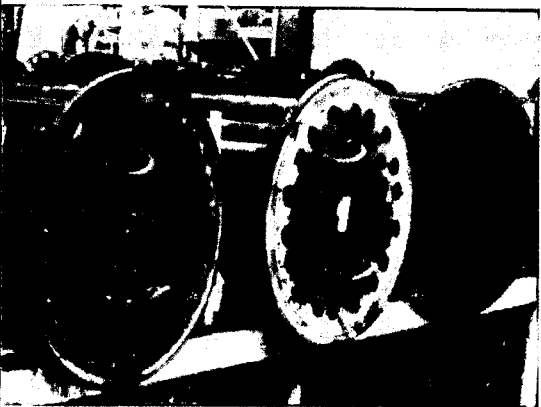
Schematic of isophthalonitrile production system at Diamond Shamrock

Filter modules removed for inspection and cleaning

ized beds were not considered efficient enough for this process. Therefore, Diamond Shamrock installed a porous metal blowback filter system on the exit gas stream from each fluid bed to provide positive particle retention.

The overall system (see flow chart) provides parallel banks of filter vessels on each fluid bed to allow sequential blow-back of each vessel. To accommodate the different flow conditions in the two fluid beds, the reactor was equipped with 6 vessels while the re-oxidizer was equipped with 8.

Initially, each vessel was equipped with 57 1/4" diam filter elements fabricated from sintered stainless steel powder to provide removal of particles 3 microns and larger. Since this was the first operating system of any size for this process, the startup was not uneventful. Operating conditions of the re-oxidizer were slightly different than anticipated. The stainless tubes experienced embrittlement, cracking, and buildup of catalyst between tubes. Thus, a change in the filter element configuration and metallurgy for the eight reoxidizer filters was



Heavy insulation covers porous metal filters on top of high temperature fluidized bed

required. Each vessel on the re-oxidizer still provides about 150 sq ft of filter area, but now contains 2 $\frac{3}{8}$ " diam elements constructed of a sintered Inconel® high nickel alloy. Designed to retain particles

greater than 1 micron, the filter tubes have successfully withstood the service requirement.

Filter vessels are blown back sequentially on a timed cycle, using approximately two vessel volumes of gas for each 5-7 sec blow-back. Every 15 seconds a filter is blown back. This periodic fluctuation of gas flow through the system does not cause any noticeable disruption of the fluidization or elutriation characteristics of the units.

Since modification of the re-oxidizer filter vessels, maintenance on the filter has been minimal. High retention of costly vanadium catalyst within the beds and infrequent cleanout required of the filters have resulted in an economically sound entrainment separator system. Discharge of catalyst to the atmosphere is within acceptable limits and catalyst loss to the product stream is so low that only a

minor amount is collected in the recovery system feed tank—too little to justify recovery—and discarded by an infrequent purge.

PSS® porous metal filter supplied by Pall Process Filtration Corporation, Cortland, NY 13045.

Inconel® alloy is a product of Huntington Alloys, Inc., Huntington, WV 25720.

Aromatic nitrile process technology, engineering design and construction provided by C-E Lummus Co., Division of Combustion Engineering Inc., 1515 Broad St., Bloomfield, NJ 07003.
