A WORLD LEADER IN INDUSTRIAL CERAMIC PRODUCTS

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SILICA REDUCTION IN SECONDARY REFORMERS

Hydrogen produced in the primary reformer at 1800°F (980°C) passes through a transfer line to the secondary reformer where it is mixed with steam at about 2450°F (1340°C), passes through a catalyst bed and exits to a waste heat boiler at 1800°F (980°C). From there it passes through the high temperature shift converter at 900°F (480°C), the low temperature shift converter at 450°F (230°C) through the methanator.

When ammonia plants had a capacity of less than 400 T/D, alumina-silica refractories were used in the transfer line, the secondary reformer and the waste heat boiler. As capacities increased, it was observed that there was a breakdown of the refractory with the silica being leached out as SiO and, picking up oxygen from the steam, deposited as a fine SiO_2 dust on the tubes in the waste heat boiler thereby reducing its thermal efficiency.

Dr. Wygant of Amoco first identified this leaching out of silica as a reaction caused by nascent hydrogen (H). Above 2100°F (1150°C), molecular hydrogen (H_2) changes to mono-atomic hydrogen (H). Later, Charlie Venable of Phillips Petroleum identified the same reaction by steam above 1500°F (815°C). Of the two reactions which were occurring, the steam reaction is probably the one of most concern in secondary reformers.

These identifications led to the decision to use high alumina refractory material in the secondary reformer and transfer line. High alumina support media and catalyst carriers were also chosen for use in the secondary reformer. **However, materials containing low levels of silica are what are really required**. High alumina materials are used because they are the most readily available and are the economical product on the market to achieve low silica (SiO_2) levels.

It was for this reason that Christy developed PROX-SVERS® T-46 Alumina Balls in 1962 and PROX-SVERS® T-99 Alumina Balls in 1999, both of which approved for use in secondary reformers by process licensors, catalyst manufacturers and end users throughout the world. Some users prefer to exclusively utilize T-46 or T-99 alumina balls throughout their ammonia plant so that balls containing silica do not inadvertently get placed into the secondary reformer.

Layers of alumina balls are used over the perforated dome in the bottom of the secondary reformer up to the catalyst interface.

On top of the catalyst bed, a disperser is needed to prevent churning of the bed and to achieve uniform gas distribution. Several specifications call for 99% alumina Hex-Tile, but 50 mm or 76 mm alumina balls are also used. These products typically have enough mass to resist dislocation by the high velocity gas stream. Please see our Hexagonal Target Tile bulletin for more information.

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