MOLECULAR SIEVE DUSTING

Molecular sieve dusting is a severe issue in adsorption plants, very often observed in units treating Natural Gas. If the dust consists in the adsorbent, the primary cause is very often not the molecular sieve itself, but how it was used or how it is installed.

Molecular sieves consist in general in 80% active material, the zeolite, and 20%C binder, allowing to put the active material in shape, beads or pellets. This binder determines the physical properties of the adsorbent, such as density and mechanical strength (crushing strength) but may have a certain chemical activity, too (not treated in this newsletter). Molecular sieve dusting is very often detected by pressure drop increase over the adsorber, or in the filters downstream of the unit.

The dust formation may have different origins: 

① during the loading dust will be formed due to the fact that the beads or pellets are moved. Nevertheless, after start-up this quantity of dust formed will rapidly decrease. The manipulation of the products should be reduced to the minimum, in order to reduce the quantity of dust formed. In the case that the adsorbent is unloaded, very often by vacuuming from the top, not only a lot of dust will be formed (and in case of reuse of the adsorbent put in the vessel), but the average particle size will be smaller and pressure drop over the bed higher. Reuse of unloaded adsorbent is not recommended.

② The second cause could be a bad regeneration procedure. If the bed is heated up too fast, the desorbed water from the bottom layers will be condensed in the top layer, followed by boiling of the sieve in liquid water leading to hydrothermal damaging (attack of binder and zeolite). Figure 1 shows a unit having faced this situation. A view from the top of the adsorber shows dust and intact product.

③ A third reason could be a failing support grid. In this case there is leakage between the grid and the vessel walls. This is proven by detection of dust and particles (see figure 2) in the downstream filter. Very often a significant amount (“slug”) of dust is detected when switching from regeneration to adsorption, when the support grid is moving. Filter producer may provide sampling devices to detect if there is a continuous formation of fines or if it appears in “slugs”. To well identify the reason for dust formation a detailed analysis of the pressure drop evolution and the regeneration temperature trends can give indication before opening the vessels (linked with production reduction or loss) for a detailed bed analysis. It is recommended to involve molecular sieve specialists to prevent wrong conclusions.

In our next issue we will discuss acid gas resistant sieves.

Meet us at GASTECH, March 21-24th in Amsterdam, booth A31

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