ProTips™

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Sulphur Converter Catalyst Deactivation

The Sulphur Converter in a Sulphur Recovery Unit (SRU) is responsible for continuing the Claus reaction of H_2S and SO_2 over a catalyst to form elemental sulphur, S_x and H_2O, where S_x is predominantly in the form of S_2, S_6, S_8 depending on temperature and pressure. This is a kinetic reaction driven by the available surface area of the catalyst and there are a number of ways the catalyst can lose surface area, or deactivate. Deactivation can be either reversible or irreversible and is extensively discussed in The Contactor™ Volume 12 Issue 5.

In SulphurPro®, the catalyst activity is a manual input within the Sulphur Converter dialog as shown in Figures 1 and 2.

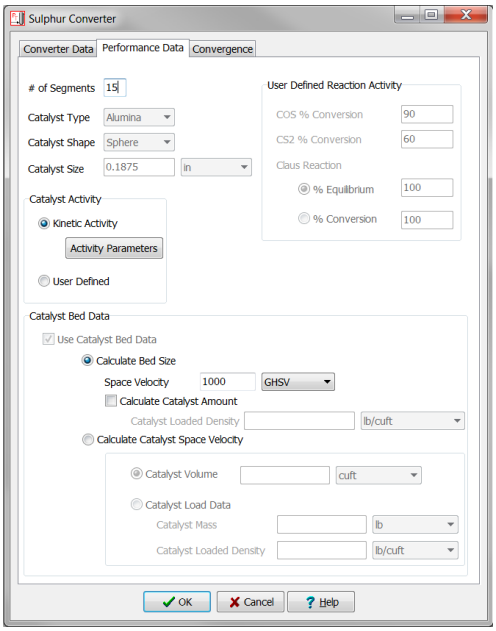

Figure 1: Converter Performance Data Dialog

Figure 1 shows the dialog where catalyst information is entered. It includes the number of segments, catalyst activity type (kinetic rates or user defined), and catalyst bed data needed for sizing or rating.

Figure 2 shows the kinetic activity dialog which contains a slide bar to account for all levels of deactivation from fresh new catalyst to completely dead catalyst and anywhere in between. There are also three quick settings provided for fresh, acceptably aged, and fully aged/dead catalyst. This slide bar is used to tune the catalyst deactivation in the model to match the level of deactivation in the actual operating plant.

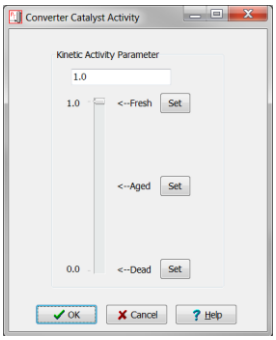

Figure 2. Catalyst Kinetic Activity Dialog (Deactivation)

Figure 3 shows SulphurPro® temperature profiles compared to real operating plant temperature profiles. The first converter bed was modelled with both fresh catalyst activity and aged catalyst activity. As seen from the graph, SulphurPro® matched very well for converter beds 2 and 3 while converter bed 1 operating data showed the bed was deactivated from top down indicating non-hydrothermal aging. However, the aged simulation predictions showed a close match to the operating data.

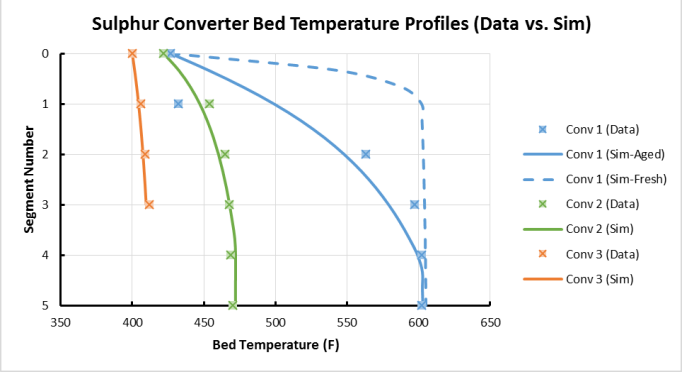

Figure 3. Temperature Profiles from Operating Plant vs. Simulation Predicted Temperature Profiles.

PROTIP: While there are a vast number of deactivation mechanisms, SulphurPro® only models uniform hydrothermal aging as this is the only readily calculable deactivation mechanism.