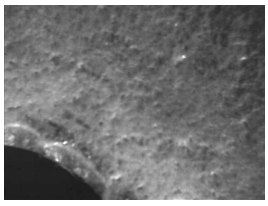
Solve Wear Problems in Process Design

Material Flow Solutions, Inc.



Wear in process equipment depends on the local stress and the local velocity of the bulk material. In general, wear is directly proportional to the local velocity, but may vary in a non-linear way with the stress level. Wear usually increases with increase in velocity and increase in stress level. Thus, zones of high wear are due to either high stress or high velocity. One high wear zone is the region near the top of a hopper where pressures are high but the velocity is low. A moderate amount of wear will likely occur on the hopper surface. A high to moderate wear zone is the region near the hopper outlet where the stress level is low but the velocity is high. If the relationship between the stress, velocity and the type of expected wear expected on a given wall material is known, then one can compute stresses and shear velocities in process equipment and use this data to estimate wear in process equipment.

It is critical to measure wear properties on the particular wall material of interest. In some cases, a hard wall material that is brittle may be subject to more wear than a softer material that is ductile. In other cases, brittle material may have pore structures that induce localized high stress zones and initiate wear due to the formation of subsurface cracks which create a pocked surface during shear events at higher pressures. Brittle materials may show very good wear at lower stress levels since they are hard and the stress must reach a given level to initiate a crack. Ductile materials are soft enough that particles rubbing on the surface dig into the surface like a plow and rip or tear the material, forming groves and a scratch pattern in the direction of flow.

The first step in solving a wear problem is to measure the wear rate at several stress levels and velocities. At Material Flow Solutions we utilize a tester that controls the stress level and the velocity against a surface of wall material and measures the loss in weight of the wall material due to shear effects. The bulk material is refreshed on the wall surface continually to assure proper measurement.

The next step is to compute stress level and velocity in the process equipment and then use the wear properties to estimate the wear rates in key equipment locations. If possible, the high wear zone(s) identified in this analysis should be made of replaceable material. Hopper sections should be constructed in such a way as to allow easy replacement of high wear zone pieces.

When designing or selecting feeders, identify the regions of high velocity/high stress and design replaceable wear plates in these regions. Special equipment designs can be used to reduce the local stress level. It is often possible to reduce the stress level by a factor of two through optimal design, thereby reducing the wear rate by at least a factor (sometimes more).

At Material Flow Solutions we use measured wear rates and our knowledge of stress and velocities in process equipment to significantly reduce the wear in process equipment and provide optimal design recommendation to accomplish your task.

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