TORBED* Process Reactor Technology

Technology Description

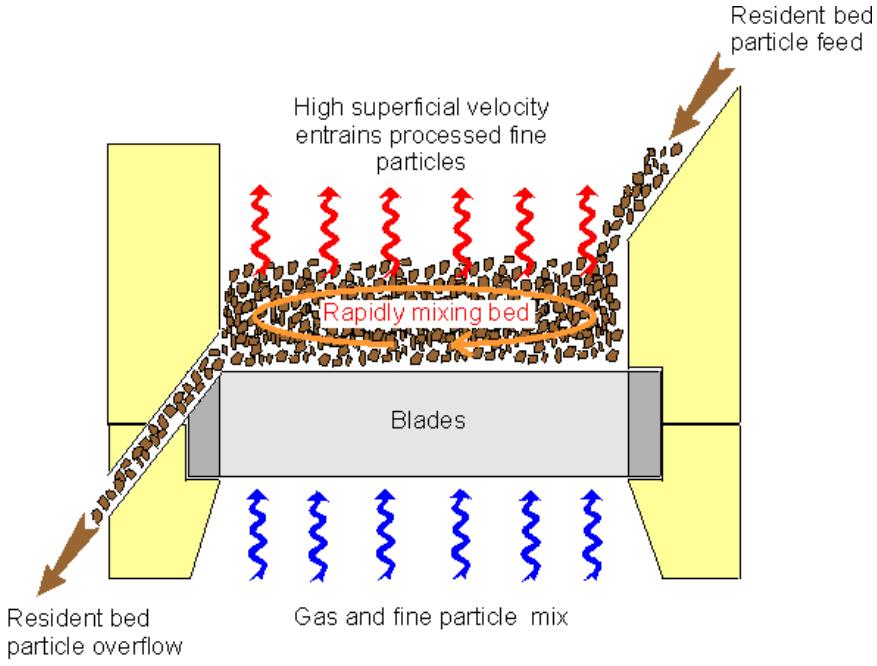
FINE POWDER PROCESSING

Background

Efficient gas/solid contacting where fine particles are involved can be a technically challenging assignment. Although reduced size usually makes the material more reactive, keeping it in the reactive environment for a sufficient amount of time can be difficult to achieve. Conventional unit operations are often completely unsuitable for this task. By employing a re-circulation strategy, circulating fluid beds overcome the retention time issue but at the expense of simplicity and cost. As such, the viability of these units is restricted to high value added and/or very large throughput applications. An enhancement to the basic TORBED reactor concept overcomes both these issues.

The fine powder injection process

In this mode of operation, the reaction zone of the TORBED unit is occupied by suitable inert material which act to form a "resident" bed. The fine powders are injected into the reactor just above the distributor where they then become entrained in the bed above. The resident bed not only ensures good mixing between the gas and the powder, it also creates a torturous path for the particles thus extending their residence time. In addition, the resident material improves the quality of heat transfer by providing thermal inertia and greater surface area for heat transfer.



Extra gas-solid contact time can be provided in the freeboard above the bed. Particles leaving the bed follow a spiral path out of the reactor, forming bands on the upper wall. When the mass of these bands exceed the carrying capacity of the air, they collapse, returning material to the bed thus creating an internal solids recycle loop.

The net effect is enhanced transfer properties and extended residence time without the need for a large and complicated reactor.

Major benefits

In comparison with conventional techniques, the benefits associated with the TORBED Powder Injection system are:

- Extended particle residence time in the gas stream
- Independently adjustable solids and gas retention times
- Enhanced interparticulate and interphase heat and mass transfer
- Isothermal reaction environment
- Accurate temperature control with near adiabatic conditions possible
- Smaller, simpler reactor
- Low pressure drop
- Potential to de-bottleneck existing plant by treating fine unreacted material that by-passes the main reactor

Because processing under such conditions has not been previously possible, the results can be unexpected and defy "conventional" wisdom. For example, the specific surface area of many solids increase dramatically upon processing. This is due to the formation of fissures, and the effect can lead to increased activity of the solid in downstream operations.

Applications

This technology tends to be most applicable to materials with a diameter less than 100 microns. Typical feed stocks originate include:

- Process filter cakes (wet or dried)
- Industrial minerals
- Mineral concentrates

Because of its small size, the TORBED reactor has also been retrofitted to existing plant to address the issue of unreacted fines by-passing the main processor.

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