TORBED* Process Reactor Technology

Technology Description

TORBED COMPACT BED REACTOR ('CBR')

The TORBED Compact Bed Reactor ('CBR') transfers heat and mass between gases and solids more quickly and efficiently than any comparable process. Heat and mass transfer rate is dependent on the resistance to flow. This is determined by several factors, the most important of which is the effect of a microscopically thin boundary layer of gas that surrounds each particle. This boundary layer has an insulating effect, hence the more it is reduced in thickness, the less the resistance and the more quickly heat and mass transfer can be achieved. This microscopic boundary layer can be reduced in thickness by subjecting the particles to turbulent impact by the process gas at high velocity.

Why a CBR achieves faster heat and mass transfer

In the CBR, the layer of moving particles to be processed is held in suspension by jets of the process gas. These jets are created by passing the process gas stream through the slots between stationary angled "blades" (similar to closely spaced stationery turbine blades) so that the high velocity energy generated as the process gas passes through these slots is dissipated on the base of a shallow bed of particles. Where the base of this bed is impacted by the high velocity jets, a highly turbulent area is created imparting both vertical lift and horizontal motion to the bed. (See Fig. 1)

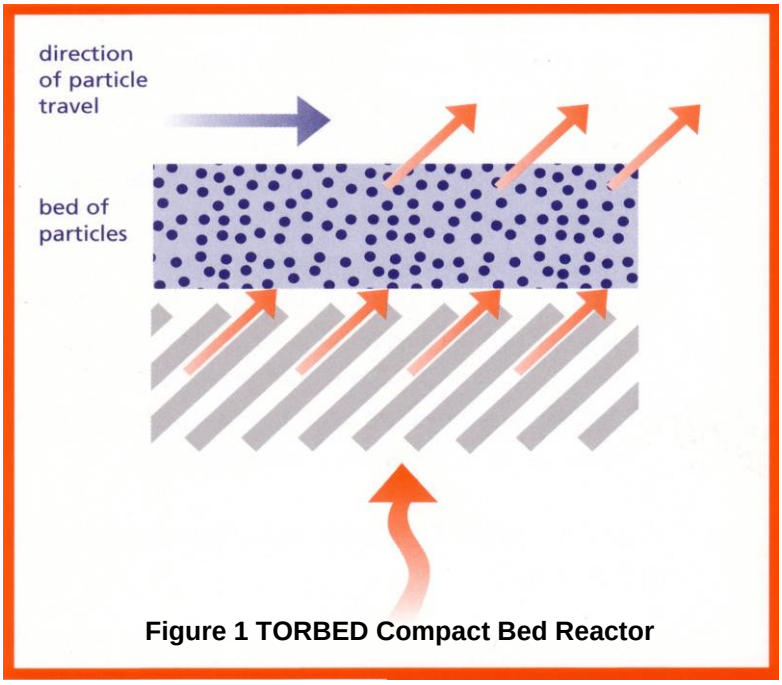


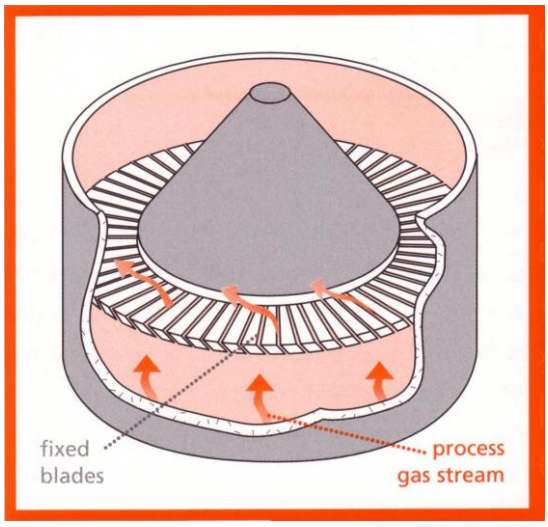
Figure 1 TORBED Compact Bed Reactor

A given bed mass can be supported either by a large mass flow of process gas at low velocity or by a smaller mass flow of process gas at higher velocity. In a Compact TORBED reactor, the mass flows can thus be chosen to optimise the process. The annular shape of the CBR creates a compact gently rotating bed of material which describes a **TOR**oidal **BED** circulation pattern above the blades. Indeed, this motion led to the creation of the TORBED Process Reactor Trade Mark.

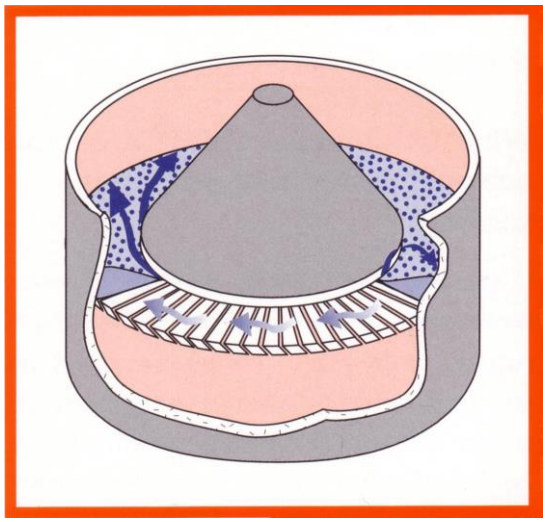
Although the process gas stream leaving the blades in a Compact TORBED reactor may exit at speeds many times that which would entrain all particles, the high impact velocity is dissipated against the base of the shallow bed while superficial gas velocity can remain low enough not to carry away smaller particles.

Major advantages of the CBR

- The substantial de-coupling of hot gas mass flow and 'fluidising' velocity
- A high velocity drop or gradient through the bed means that substantially ungraded material can be processed
- High impact velocities provide exceptional heat and mass transfer
- The bed shape presents a large surface area to the blades in proportion to the bed volume, particularly beneficial where the blades are at high temperatures
- A shallow bed (typically a few centimeters) provides very small solids hold up and rapid response to process control
- A high specific throughput is achieved
- The static pressure loss through the process is low, often an order of magnitude less than conventional fluidised bed techniques. Process gas recirculation at high temperatures is thus more simple bringing energy savings



Process gas flow through fixed blades gives toroidal particle motion. By producing an annular processing region with toroidal mixing, material is continuously passed through the base of the bed where the high heat and mass transfer occurs. This ensures uniformity of processing



The TORBED CBR - already proven in many industries

TORBED Compact Bed Reactors are being used with great success in widely different industries, including minerals, metals, chemicals and foods. Most installations today are full size, not prototypes, and have given tens of thousands of hours of totally satisfactory operation. For all these reasons, the Compact TORBED reactor is now well established as an efficient, viable and more cost effective alternative to many conventional fluidised bed and rotary kiln processes.

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