Ultrasonic deblinding can increase both productivity and sieving flexibility in a range of powder processing applications.

Ultrasonic Deblinding

by **Rob O'Connell,** Marketing Manager, Russell Finex Ltd., London, England

Sieving generally ranks low on most plant investment lists, but for companies that handle fine powders, accurate particle size separation is of the utmost importance. Blinding—which occurs when the powder blocks the sieve mesh during the separation process—can be a serious problem.

In many cases, a technique called ultrasonic deblinding can provide the answer. While this method has been used for more than 25 years to prevent screen apertures from being blocked in a variety of applications, it has only recently begun capturing the attention of the ceramic industry. With ultrasonic deblinding, ceramic manufacturers can prevent production slowdowns in their screening operations, sieve powders with finer meshes and dramatically increase their screening capacities.

A Blinding Problem

Screen blocking or blinding is a common problem when sieving difficult powders on screens of 300 microns and below. It occurs when one or a combination of particles sits on or in an aperture of the mesh and stays there, preventing other particles from passing through these openings, and it is particularly common with powders that are sticky or that contain a lot of particles that are similar in size to the mesh apertures. When blinding occurs, the useful screening area and the screen's overall capacity are reduced, slowing down production levels.

Many companies try to clean their screens manually, but this often results in the mesh becoming damaged or broken. Other companies use screening systems that incorporate mechanical devices, such as discs or balls, which bounce up and down, hitting the screen and shaking free any blockages. Unfortunately, the action of these discs can also damage and reduce the life of the mesh. Even more seriously, as these devices wear down, pieces of their rubber or plastic construction can fall off and contaminate the powder being sieved. Another disadvantage with mechanical deblinding systems that is becoming increasingly relevant in today's health- and safety-conscious manufacturing environment is the noise these devices generate—noise levels of over 90 dB(A) have been recorded with some deblinding disc assemblies.

An Ultrasonic Solution

An ultrasonic deblinding system can eliminate all of these problems. In ultrasonic deblinding, an ultrasonic frequency is applied to the sieve mesh using an acoustically developed transducer. The frequency breaks down the surface tension, effectively making the stainless steel wires friction-free and preventing particles that are slightly greater and smaller than the mesh from blinding or blocking the screen mesh.

The components of an ultrasonic deblinding system.

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Case Studies

Powder Coatings

The United States Council for Automotive Research (USCAR), which is composed of leading U.S. car manufacturers Ford Motor Co., Daimler-Chrysler and General Motors Corp., is using two ultrasonic mesh deblinding systems in a joint research program looking into ways to reduce solvent emissions from automotive painting systems. Based at the $20-million, 107,000-square-foot Ford Assembly Plant in Wixom, Mich., the USCAR study also aims to accelerate the introduction of solvent-free technology, and, in particular, focuses on determining whether powder clearcoat is smooth and durable enough to be used as a clear vehicle topcoat.

Car manufacturers have used powder as anti-chip and primer surfaces on many components for some years to increase durability, and more than 10 car manufacturers have purchased ultrasonic vibratory sieving machines in the last three years. However, frequent color changes have made powder unsuitable for use as a color coat and have also limited reclaiming capabilities.

The USCAR project involves the application of a powder clearcoat to car parts under strictly controlled conditions before the bodies are subjected to rigorous tests, the validity of which relies entirely on the quality of the powder. To ensure the high quality standards and throughput required, two high performance sieves fitted with ultrasonic mesh deblinding systems have been installed above powder hoppers in the powder kitchen, which pumps both virgin and reclaimed powders. After sieving, the powder is pneumatically conveyed to a 33-ft downdraft spray, where spraying equipment automatically applies the powder clearcoat to the car bodies before testing.

Previously, it had been difficult to screen fine powders efficiently over long periods of time using rotary sieves due to progressive mesh blinding. However, using the ultasonic deblinding system, this problem has been eliminated—even on mesh sizes down to 75 microns—providing improved plant efficiency and continuous operation over many shifts.

In addition to reducing downtime, the ultrasonic system also extends screen life from weeks to months while giving exceptional precision and dramatically increased throughput.

An ultrasonic deblinding system being used to help sieve metal powders at Mining and Chemical Products Ltd., Northamptonshire, UK.

Metal Powder

The metal powder industry has also benefited from ultrasonic deblinding. One iron powder company was producing powder at 2000 kg/hour on a 24-hours/day, 7-days/week schedule. The firm was using 30 conventional 1200 mm diameter vibratory sieving machines with 200-micron mesh screens fitted with discs, but found that blinding still occurred progressively. As a result, production had to be stopped every two days and a wire brush applied to the mesh. After 14 days the mesh was so badly blinded that it had to be replaced. During this process, the specification of the powder naturally varied with the degree of blinding.

To combat the problem, an ultrasonic deblinding system was fitted and the capacity increased to 2500 kg/hr through a 200-micron mesh with a constant specification of finished product. Mesh life also increased from two weeks to over three months due to the elimination of manual cleaning.

Glass Frit

Ultrasonic deblinding systems have also been used to solve the problem of glass frit blinding and blocking the stainless steel mesh of screening machines. Glass frit particles are very irregular in shape and will blind a 100-micron (150-mesh) standard screen almost immediately. After fitting the screens with an ultrasonic deblinding system, a capacity of approximately 400 kg/hr can be expected.

An ultrasonic deblinding system probe mounted on a separator.

The system is composed of three parts:

1. The control unit, which houses all of the electronic components driving the system;
2. The acoustically developed transducer, often referred to as the probe; and
3. The mesh screen, which includes a special velocity transfer plate (VTP) to which the probe is connected.

The probe is bolted to the VTP, which, in turn, is bonded to the stainless steel wires of the sieving mesh. When the system is activated, the control box sends signals to drive the piezoelectric element in the probe through a single cable, and the probe is excited at its resonant frequency of 35,000 Hz. This frequency excites the velocity transfer plate, which, in turn, vibrates each individual wire of the mesh and prevents the powder from sticking to them.

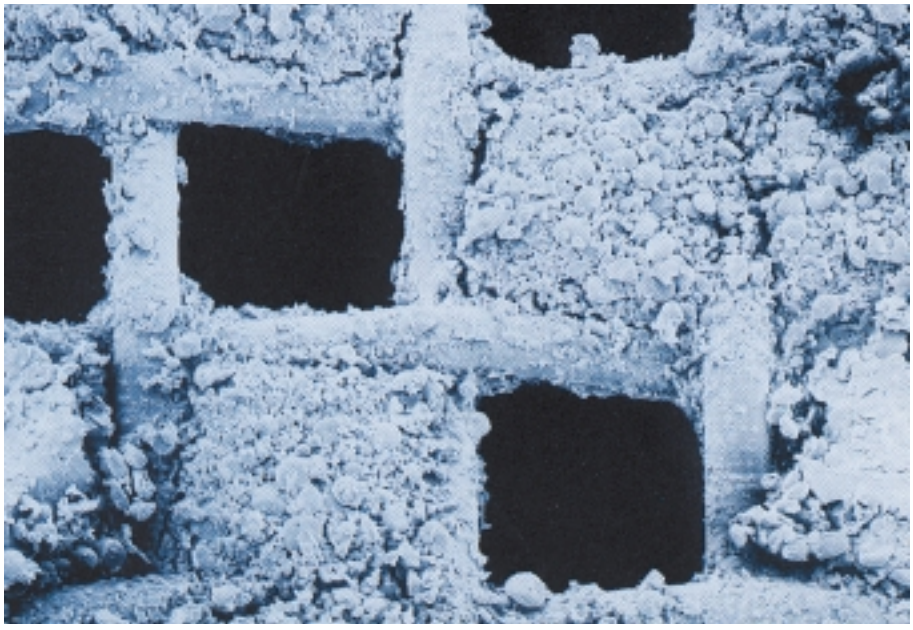
Ultrasonic systems have no mechanical or wearing parts, so there is no risk of mesh damage or product contamination. Because they keep the mesh from being blocked or blinded, these systems ensure that screening capacity and throughput remain constant throughout the production process. They also dramatically reduce downtime for cleaning while increasing mesh life due to the reduction in manual handling.

Screening very fine powders accurately on a production scale using mesh screens of less than 100 microns was almost impossible with conventional deblinding technologies. With the newfound ability to produce accurately sized batches of powder of very small particle sizes, many companies have been able to improve the quality of their final product or even introduce new products with a higher quality or specification.

Technology Improvements

When the first ultrasonic deblinding system was developed over 25 years ago, it was a revolutionary leap forward in sieving technology. While the operating principle has essentially remained the same, the very first systems were basic in terms of operator control. Developments in this area have since been made so that each system can be individually tailored to the particular powders being sieved. Current systems, for example, offer the ability to change the intensity of the ultrasonic activity—a feature that is especially useful with light-density powders. If the wires vibrate too strongly, the powder tends to bounce off them and stay suspended above the mesh. By allowing the system to automatically turn the activity on and off in short bursts (pulsing) or vary the activity unevenly (modulation), the system enables the powder to settle on the mesh and sieve while the ultrasonic activity is off, and it disperses any blinding when the activity pulses on again.

The operator interface has also been dramatically improved to include diagnostic LED displays showing current operating conditions, as well as warnings and the locations of any problems with the system,



In a typical sieving operation, particles often combine to blind the stainless steel wire mesh. Ultrasonic deblinding systems can eliminate this problem. Photo courtesy of G. Bopp & Co. Ltd, Derbyshire, UK.

such as an incomplete connection. Additionally, today's ultrasonic deblinding systems support fieldbus connectivity, which allows them to be remotely controlled through wiring connected to the central operating room of the plant.

Attaching the System to Existing Sieves

In many cases, ultrasonic deblinding systems are specified with new sieving devices. However, the systems can also be installed on existing sieves. Most modern sieving units have adjustable weights attached to the driving motor, which are used to vary the amplitude of vibration of the unit and the speed at which material travels across the screen while sieving. It is often necessary to adjust these weights after adding an ultrasonic deblinding system to the unit to ensure that the existing sieving unit and the ultrasonic deblinding system fully complement each other.

If, for example, the amplitude of vibration of the sieving unit is set too high, then the ultrasonic deblinding system will not be at its highest efficiency since the powder will not be in constant contact with the mesh. In practice, great care is needed to set up both systems in order to get the most out of the combination, so this type of installation is generally best left to an engineer with experience in both technologies.

Enhancing Sieve Performance

Today's ceramic manufacturers can't afford production slowdowns or quality problems due to an inefficient sieving operation. With an ultrasonic deblinding system, manufacturers can prevent screen blinding while also enhancing their sieving capabilities.

For more information about ultrasonic deblinding, contact Rob O'Connell, Russell Finex Ltd., Browells Lane, Middlesex, London, England, TW13 7EW; (44) 20-8818-2000; fax (44) 20-8818-2055; or e-mail rob.oconnell@russellfinex.com. Or contact John Edwards, Russell Finex Inc., 625 Eagleton Downs Dr., Pineville, NC 28134; (704) 588-9808; fax (704) 588-0738; or e-mail russellfinex@russellfinexinc.com. The company's website is located at www.russellfinex.com.