TECHNICAL BULLETIN

EHE

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PREVENTING PREMATURE IMPEDER FAILURES

Impeders fail as a result of damage caused either by heat or mechanical means. Nothing gets "used up", and the ferrite does not deteriorate as a result of normal operation. Taking a few simple precautions can greatly extend the useful life of an impeder & reduce costly downtime.

Impeder Cooling

All impeders require cooling. Most operators use mill coolant, which is adequate in many cases, however impeder life can generally be increased by using clean, filtered coolant and cooling it to 50°F or lower. A small refrigerative cooler or heat exchanger can reduce the temperture of the coolant entering the impeder by 40°F or more & greatly increase its cooling capacity. For additional information on impeder cooling, please refer to our Technical Bulletin "Cooling considerations for impeders".

Mechanical Wear

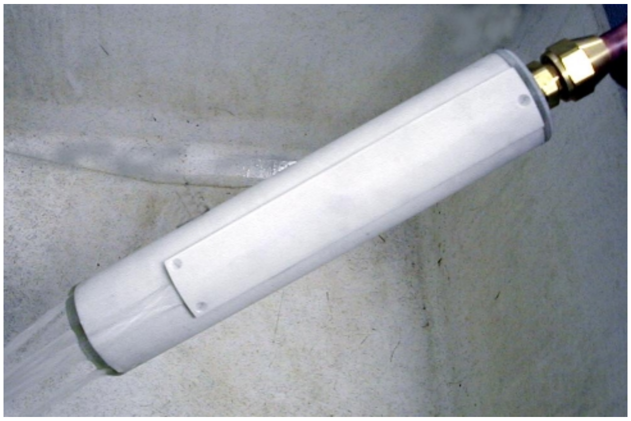
Most small impeders are attached to a length of copper tubing and allowed to rub on the bottom of the tube. This causes wear on the impeder casing which often accelerates failure. In addition, the ferrite is positioned too low in the tube, where it is less effective.

A rigid impeder support system that keeps the impeder away from the inside of the tube will greatly extend its life, as well as producing a more consistent weld & higher production speeds for a given amount of weld power. Adjustable impeder supports are available from EHE for all sizes & types of impeders.

The "Spume" problem

The most common cause of impeder failure is an accumulation of "spume" or weld spatter, which burns away then end of the impeder & allows the ferrite to be released into the tube. Weld spume is not generally a problem with low carbon steels, although it may occur as a result of bad slitting, worn mill tooling, or incorrect setup of the fin passes.

Stainless steels & coated materials (pre-galvanized or aluminized) may produce weld spume that cannot be eliminated by conventional means. In these cases, special impeder designs are available that largely overcome the problem. The simplest of these is a through flow impeder in which the ferrite extends a short distance beyond the end of the casing. These “exposed ferrite impeders” are available in sizes from 6mm to over 50mm. In this type of impeder, the ferrite is attached to the impeder coupling, rather than being retained by a pin or plug attached to the casing. Coolant flow over the exposed ferrite sweeps any molten material away from the impeder & prevents it from accumulating.


IMPEDER WITH CCOLANT FLUSH

A variation on this design uses a small amount of coolant directed across the top surface of a conventional through flow impeder, to achieve similar results.
In those cases where return flow impeders must be used to keep the tube I.D. dry, eliminating the weld spume is more difficult. Directing a flow of air, nitrogen or argon agross the top surface of the impeder is helpful in some cases, but this is not nearly as effective as using coolant as a flushing agent.

Impeders are now available with alumina ceramic outer casings. These are a lot more resistant to spume build up, but they are less tolerant to mechanical shock than the commonly used glass reinforced epoxy & silicone composite materials.

Most spume is caused when a thin wire edge forms on the corners of the strip, either as a result of excessive clearance on the slitting knives, or as a result of worn tooling on the fin passes. As the wire edge is led into the weld vee, it burns off, depositing molten metal & oxides onto the impeder. These wire edges are often visible as slivers or “steel wool” in the fin pass & weld areas of the mill. In addition to causing spume, they frequently cause pre-arcing in the weld area. This in turn leads to weld defects and coil damage.

Weld spume also occurs with coated steels. The commonly used coatings of zinc and aluminum melt at much lower temperatures than the steel. Because the heat is applied very quickly, zinc, and in some cases aluminum is vaporized rather than melted. The vapor then condenses or sublimates onto the relatively cool surface of the impeder, where it accumulates as spume. This vapor can be directed away from the impeders by a fairly weak flow of water or gas.

Conclusion

Impeders are a low cost consumable, given the other costs of operating a tube mill, however the cost of downtime involved in changing an impeder can be considerable. An average impeder costs $20-30, but even the most conservative estimates of downtime for a small mill are in excess of $500 an hour. The cost of replacing an impeder is therefore at least 10 times the cost of the impeder itself. It does not make sense to buy cheap impeders if they do not last as long. Any steps that can be taken to extend the life of an impeder & reduce downtime will add to operating profits.

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