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Guided Wave Systems for Screening Boiler Tubing Damage

Using explosives is a standard method to remove slag on the fire side of boiler tubes. This requires less cleaning time and reduced scaffolding than mechanical removal and results in increased safety for personnel removing the slag.

However, the explosive force can cause damage to the tubes. That damage is usually axial cracking on the exposed side or the rear side of the tube.

Researchers at Southwest Research Institute® (SwRI®) found that using torsional guided waves to detect axial notches in pipes and tubes is a feasible and safer solution. The researchers mounted a probe on a claw-type device that allowed quick clamping around the tube. The probe can accommodate tubes when they are slightly oval-shaped and can operate in frequency range of 40-170 kHz.

The researchers wrapped a high-powered magnetostrictive transducer (MsT) with a solenoidal excitation coil around an iron cobalt (FeCo) strip. A belt of built-in permanent magnets provided magnetization of the FeCo.

Advantages of using MsT probes:

- High signal amplitudes produced by the solenoidal excitation coil allows signal-to-noise ratios above 60 dB
- Consistent signal amplitudes over long periods due to stable permanent magnets
- Ruggedized transducer design allows for multiple applications or long-term use of the same transducer

This method can be applicable to long range (few meters) guided wave testing of boiler tubes with axial notches. Axial notches as small as 25 percent depth were detected. However, due to the expected increase in coherent noise in actual boiler tubes, detection of 40 percent depth and deeper cracks is expected.



Claw type MsT transducer and MsR303R instrument used for guided wave screening of boiler tubes.



MsT probe testing on boiler tubes and a longitudinal crack formed by explosive cleaning.

**We welcome your inquiries.
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swri.org/magnetostrictive-sensor-based-guided-waves

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