Ultrasonics boost integrity inspections of gas pipelines

Rosen's latest developments in ultrasonic technologies provide a powerful mechanism for inspecting the integrity of a natural gas pipeline.

Given the increased focus on natural gas as a viable energy alternative to oil, a greater demand for more accurate, and cost effective pipeline inspection technologies has arisen. The safety and reliability of these pipelines is of great concern given the high pressure and compressible nature of the medium.

A major integrity threat to a natural gas pipeline is due to cracks. Traditionally, they tended to be formed during fabrication or installation stages of a pipe lifecycle. More recent findings have shown that cracks arise in-service from such crack growth mechanisms as external stress corrosion cracking (Fig. 1) or sour service based hydrogen induced cracking and sulphide stress corrosion cracking (HIC and SSCC). These forms of cracks are difficult to detect using conventional magnetic flux leakage (MFL) techniques. MFL requires larger open cracks or a more open structure present in a corrosion zone to be effective. The complex and closed structure of cracks make it virtually impossible for detection by disturbance of the magnetic flux. Fortunately, an ultrasonic wave will be reflected by a crack like structure regardless of the exhibited closed structure. The resulting echo can be detected and measured to provide a clear indication of a crack feature normally not detected with other techniques.

To date, ultrasonic technologies (UT) have been used successfully in the inspection of liquid pipelines. Traditionally, they have been based on piezoelectric transducers and are only applicable when an

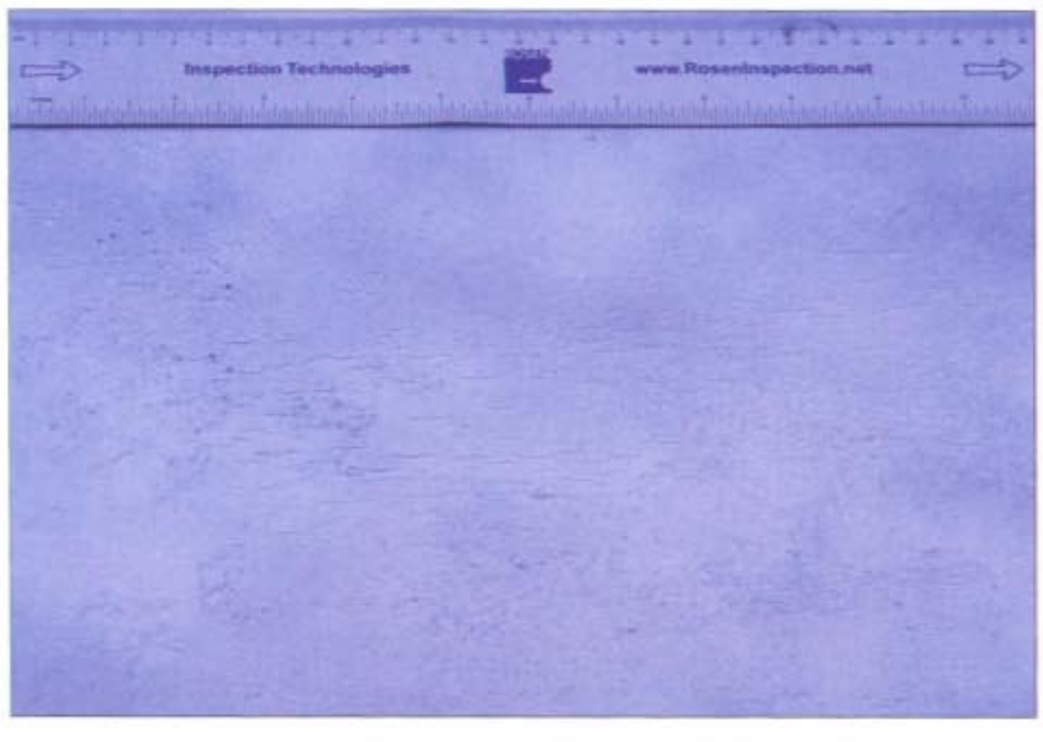

Fig. 1 Sample Highlighting Pipe Wall SCC Features.

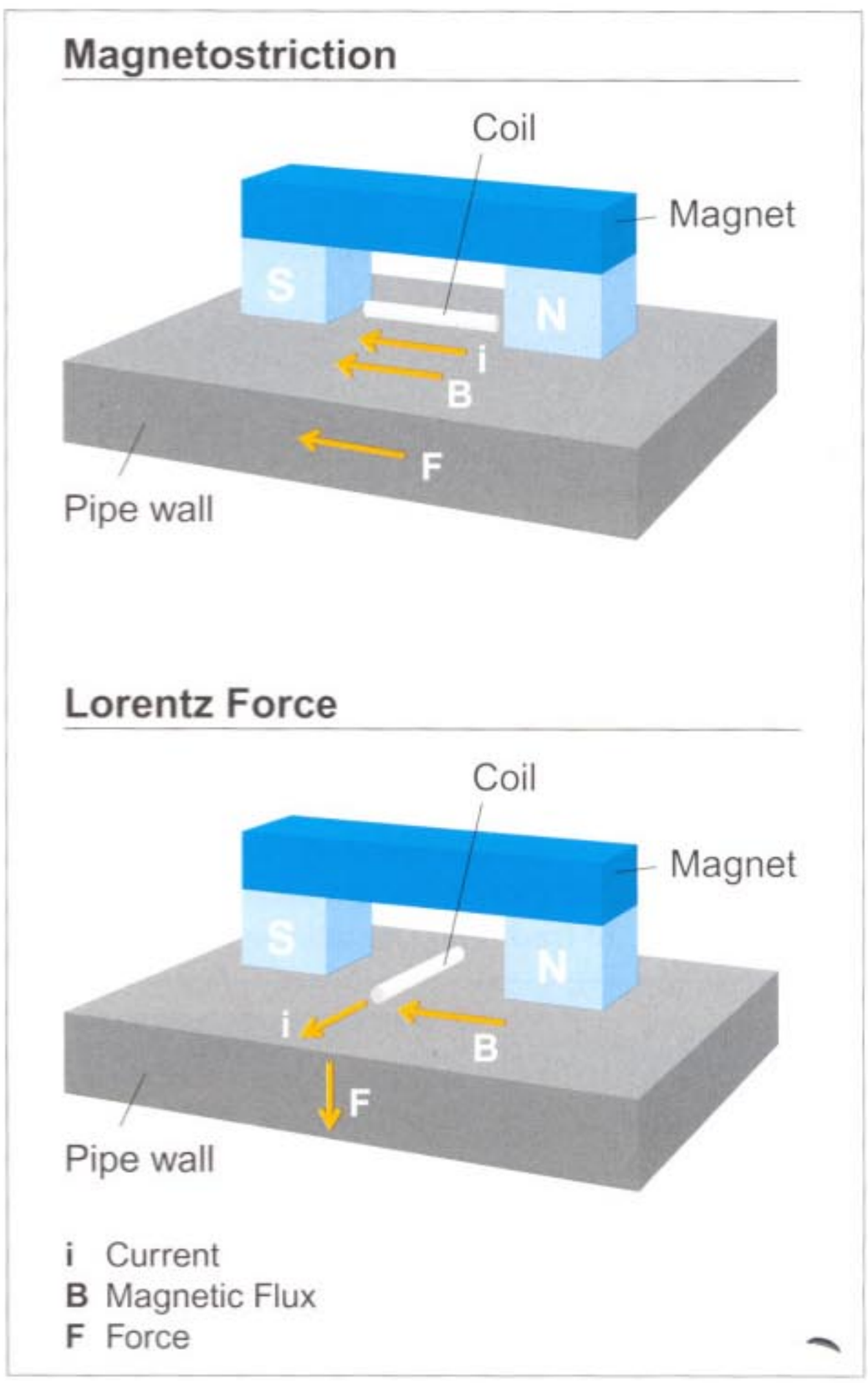

Fig. 2 Lorentz and Magnetostriction Forces Produced by EMAT.

adequate liquid couplant is available between the transducer itself and the pipe wall. Therefore, their use is effectively limited to liquid systems. Another approach is necessary to adequately inspect natural gas pipelines.

What is EMAT?

The ideal crack inspection solution for gas pipelines is a dry-coupled ultrasonic technology. An electromagnetic acoustic transducer (EMAT) provides the best realisation of this requirement. EMAT is based on the electro-mechanical conversion produced when an eddy current is applied within a static magnetic field. The resulting Lorentz forces and magnetostriction result in an interaction between the EMAT and the metal surface generating an acoustic wave within the material (Fig. 2). The material being inspected is its own transducer, eliminating the need