NDT Services from TWI

Acoustic Emission

Description

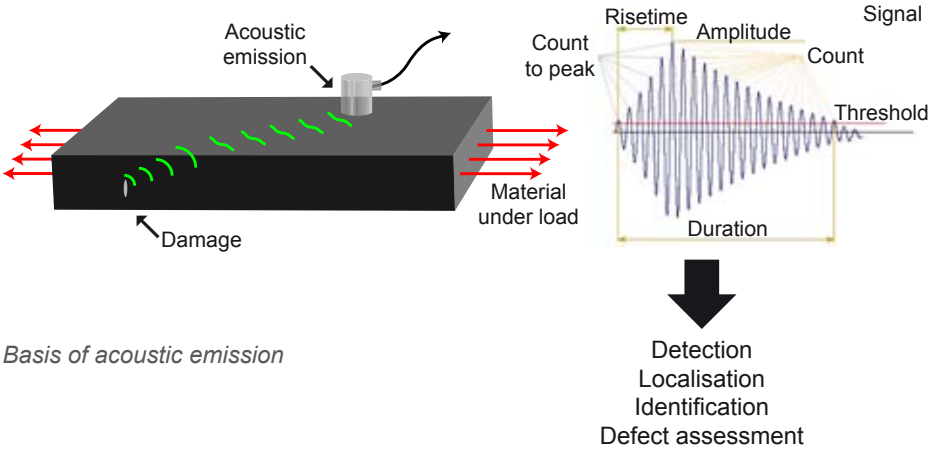
When a load is applied to a structure, it deforms elastically. Associated with this deformation are changes in the structure's stress distribution and the storage of elastic strain energy. As the load increases further, some permanent microscopic deformation may occur, which is accompanied by a release of strain energy, partly in the form of a propagating elastic wave termed 'Acoustic Emission' (AE). If these emissions are above a certain threshold level they can be detected and converted to voltage signals by sensitive piezoelectric transducers mounted on the structure's surface.

A typical AE system consists of data acquisition, amplification, processing and analysis. Various parameters are used in AE to characterise the source, including: ring down count, cumulative duration, peak amplitude, rise-time, energy, frequency and RMS (Root Mean Square) voltage.

AE can detect cracking, corrosion, friction, mechanical impact and leaks. In particular, it is sufficiently sensitive to enable cracks extending by as little as a few hundred square micrometers to be detected. It can be used to monitor metallic structures, composite materials and concrete.

It is used for:

- Pressure equipment: to monitor flaws, corrosion, and leakage in pressure vessels, LPG, tanks, piping systems, steam generators;
- Aircraft and aerospace: airframe structures, wings, bulkheads, fuel tanks, etc.;
- Oil / chemical industry: storage tanks, reactor vessels, offshore and onshore platforms, drill pipe, pipeline;
- Marine: corrosion, composite shell, engine and power plant;
- Civil engineering: bridges, dams, suspension cable bridges.



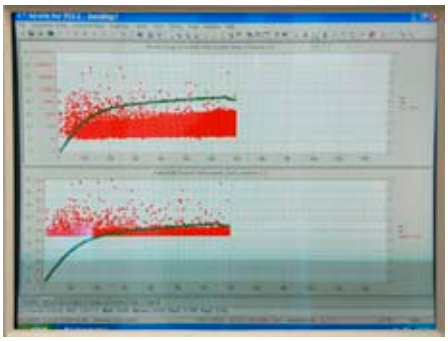
Basis of acoustic emission

An important aspect of AE is signal processing. Genuine stress-wave emissions originating from within the material must be separated from external signals, such as environmental noise (e.g. rain, wind), mechanical noise, electrical noise, etc. This is achieved by electronic filtering. The frequency of the stress waves emitted is normally in the range 30 kHz to 1 MHz. Triangulation and other techniques can give positional information and localise the sources of the emissions.

Advantages of AE are:

- Real time monitoring in service structures
- High sensitivity
- Defect localisation
- Monitoring of non accessible zones

TWI has a basic 2-channel AE system supplied by Physical Acoustics, which is mainly used in laboratory investigations.



Physical Acoustics software output showing 'events' against load on a component. The upper display shows event energy and the lower event amplitude.

For more information on the services offered in this leaflet, contact:

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