

## Frequently Asked Questions (FAQ)

Extract from the Vallen User's Group (VUG) letter

The objective of VUGinfo is to distribute information that is useful to users of AE. Especially, we would like to encourage input from AE users for providing information that can benefit other users.

These FAQs concern an AE basic application: monitoring a tensile test. It is supposed that for persons with a very sound knowledge of acoustic emission, that what follows could be perhaps even too easy. Our experience has nevertheless demonstrated that the easiest things are often the ones that require the most care.

### 1. Where to place sensors ?

This question supposes that the specimen is wide enough to allow the placement of two AE sensors on it, and that it is flat; this is the most general case. I should mention however that on specimens with round cross-sections, in some cases a milling machine could create a flat lodgement for the sensor at the contact between the grip length and the useable length. We could easily imagine that a specimen subjected to tensile tests should break at its centre, if the test is correctly executed and no previous damage is present when applying load. Thus, generally the sensors should be placed on opposite sides, but not necessarily both at the same distance from the centre. The important thing for sensor placement is rather to know beforehand what is the specimen region of interest in my test and to place sensors so that the detection region of the sensors represent only a part of this distance.

It may be useful in a series of tensile tests to sometimes place sensors on opposite faces; it is moreover desirable not to always keep the same sensor in the same position in all tests. This will assure you about the absolute reliability of your results, although more often from a qualitative point of view nothing should change, remembering that different ears listen to the same phenomenon with comparable, but a rather different, sensitivity.

### 2. How to hold sensors in place ?

Most universal testing machines hold specimens in a vertical position; hence comes the problem of maintaining the sensors

firmly in place. They need of course a couplant; although many couplants are suitable for AE sensor surface contact, silicon grease is often used, that of course is excellent for contact, but makes the sensor slipping. To fix the sensor with adhesive tape wrapped around the specimen, is efficient for many flat coupons, but sometimes insufficient in other cases, so that one could add to keep the sensor in place e.g., tweezers that tie the extremity of the sensor cable.

### 3. What kind of extraneous noise do I have to be careful with ?

If something slips (the sensor, the specimen or both) even if you do not perceive that, you will have a very clear continuous AE, unluckily not exploitable on reports, papers, etc.! But of course you are sure that nothing moves! A harmful noise could also come from the testing machine engine and can be excluded using guard sensors placed more frequently on grips. This is the case even if it is very seldom that some reflection of this noise is detected as localised events, so filtering on arrival times should suffice.

In any case and particularly if you are doubtful about electrical network insulation in your lab, it is better that your AE system is as close as possible to the preamplifiers. An ideal situation could be that the preamplifier rests on a flat part of the testing machine. We should take care that all the cables run separately to each sensor or guard, avoiding where possible the wrapping of cables on themselves and the superposition of two cables or more.

### 4. How should I choose the load application rate ?

There is no evidence that a particular load control (e.g., governed by displacement) would be absolutely the best for AE. A very fast load application however, even if recommended by tensile tests standards (that do not envisage the use of AE during the test), could bring problems of both data loss and saturation, even if corrected by the application of CASCADE HITS. A more general observation could allow us to conclude that there is surely a range of crosshead speeds in which AE monitoring on a tensile test should better show the onset and propagation of damage. If we want to go deeper in studying the material, it is perhaps more important to look for a reasonable load application speed than to follow anyway tensile test standards on this subject.

### 5. Which AE graphs should one use ?

When one uses AE to monitor a mechanical test, his idea is of course that he should detect something more than without AE, and this is quite trivial. Thus, the first thing to be assured is that with AE you can AT LEAST detect what is otherwise (e.g., by stress-strain curve) very clear. From cumulative counts (or

cumulative energy) vs. stress curve you may see the yielding in metals and the linearly-elastic limit in composites very well. The problem is a little more complicated in composite due to lay-up also playing a role in non-linear stress-strain behaviour. It is very rare, however, that this curve does not have any change of slope, so I can divide my curve (and my test) into phases, like we can do on stress-strain curves in metal. Once attained the conscious awareness that I am not losing my time with AE, the prevalent characteristics of detected events can be observed in each phase, and not only in the whole test. For a first analysis I could suggest these three questions:

<p>Where are the events? Are they all where the specimen has finally broken or not?</p>	<p>Then look at localisation plots.</p>
<p>How large are these events?</p>	<p>Then look at amplitude or energy distribution plots.</p>
<p>Do the signals have different shapes (i.e., there are different phenomena evolving through the test)?</p>	<p>duration and rise time-duration point plots, even before trying to use your transient recorder (do not be suspicious about point plots, they are more useful and clear than they seem at first).</p>

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