



## **Phenomenological Description of Acoustic Emission Processes Occurring During High-Pressure Sand Compaction**

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Compaction, pore collapse and grain crushing have a significant impact over the hydrodynamic properties of sand formations. The assessment of the crushing stress threshold constitutes valuable information in order to assess the behavior of these formations provided that it can be conveniently identified. Because of the inherent complexities of the direct observation of sand crushing, different authors have developed several indirect methods, being acoustic emission a promising one. However, previous researches have evidenced that there are different processes triggering acoustic emissions which need to be carefully accounted. Worth mentioning among them are grain bearing, grain to container friction, intergranular friction and crushing. The work presented here addresses this purpose. A broadband acoustic emission sensor (PA MicroHF200) connected to a high-speed data acquisition system and control software (AeWIN for PCI1 2.10) has been attached to a steel ram and used to monitor the different processes occurring during the oedometric compaction of uniform quartz sand up to an axial load of about 110 MPa and constant temperature. Load was stepwise applied using a servocontrolled hydraulic press acting at a constant load rate. Axial strain was simultaneously measured with the aid of a LDT device. Counts, energy, event duration, rise time and amplitude were recorded along each experiment and after completion selected waveforms were transformed from the time to the frequency domain via FFT transform. Additional simplified tests were performed in order to isolate the frequency characteristics of the dominant processes occurring during sand compaction. Our results show that, from simple tests, it is possible to determine process-dependent frequency components. When considering more complex experiments, many of the studied processes overlap but it is still possible to identify when a particular one dominates as well as the likely onset of crushing.