REFEREE'S COMMENTS TO AUTHORS

Journal: NHESS

Manuscript Number: nhess-2013-385

Authors: A.A. Panfilov

Title: The results of experimental studies of VLF – ULF electromagnetic emission by rock samples due to mechanical action

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In this paper the Author describes the results of laboratory experiments on electromagnetic emission excitation emitted by rock samples under different forms of mechanical stress.
In general it is an interesting paper. The referee recommends the publication after the following minor revisions.

As a first hint, the English grammar must be improved because it is sometimes barely acceptable.

In the following some requests of clarification.

The Author should give more details on the parameters used during the compression tests such as load velocity and so on.

In the section Experimental procedure the Author declares that the monitoring of EM emissions was held in the frequency range from 10 to 30 kHz. However in the section "Results and discussion" experimental data lower than 10 kHz are found. How is it possible? Is it a misunderstanding? Can the Author rephrase the statement?

For the friction and gradual loading experiments the recording of EM signals were carried out by a sound card and Power Graph software. It is known that the frequency detection efficiency depends on sound card type and quality, and also, a band-pass transfer function should be used. Can the Author explain if and how this function was determined?

In Figure 1 the experimental setup is reported. From the diagram it is evident that the electromagnet is placed inside the metallic box. In this way all the EM noises emitted by the device are also detected by the antenna. Is the Author able to quantify these interferences?

In the section 3.1 "Impact", the Author declares that the recorded signals for granite, granodiorite and shale were located in 0-6 kHz frequency range. However in the same section he assesses that at the time of impact on the shale samples, emissions took place in 0-9 kHz frequency range. These statements seem to be incongruent. Could the Author provide more information?

In the section 3.2 "Gradual loading", the sentence *"In a number of cases, EM signals consisted of neighbouring pulses groups, among which the main – the strongest impulses, and the series of the numerous weak, but discernible and equispaced peaks."* seems to be difficult to understand. Please rephrase the expression.

Furthermore, it is known that some of the problems in the use of antennas are due to a wrong antenna-cable coupling at the junction. These problems can provide numerous false signals if not treated in a suitable way.
From this point of view, the Author should explain what type of coaxial cable he used (length, impedance, capacitance, etc..) and if it has been evaluated and/or simulated the EM field radiated from the antenna and whether this field would have influenced his experimental measurements.
Moreover, due to rapid changes of capacitance between conductors, flexing, twisting or transient impacts on cables could cause electromagnetic noises in the signal (with a spectrum from few Hz to tens THz). This phenomenon is generally called triboelectric effect. How the Author overcome this problem? Is he able to assess that his experimental observation are not affect by this inconvenience?

Considering that not all the observations are mandatory, the Referee encourages the Author to improve his paper as much as possible based on the comments above.

Finally, the Referee suggests to extend more the bibliography related to the radiated EM failure precursor citing further important works such as:

- Lacidogna G, Carpinteri A, Manuello A, Durin G, Schiavi A, Niccolini G and Agosto A 2011 Acoustic and electromagnetic emissions as precursor phenomena in failure processes *Strain*, Vol. 47, Suppl. 2 (2011), 144-152.

- A. Carpinteri, G. Lacidogna, A. Manuello, G. Niccolini, A. Schiavi, A. Agosto: "Mechanical and electromagnetic emissions related to stress-induced cracks", *Experimental Techniques*, Vol. 36 (2012), 53-64.

- Fukui K, Okubo S and Terashima T 2005 Electromagnetic radiation from rock during uniaxial compression testing: the effects of rock characteristics and test conditions *Rock Mech. And Rock Eng*. **38**(5) 411-423 doi: 10.1007/s00603-005-0046-7

- Hadjicontis V, Mavromatou C, Antsygina T N and Chishko K A 2007 Mechanism of electromagnetic emission in plastically deformed ionic crystal *Phys. Rev. B* **76** 024106

- Hadjicontis V, Mavromatou C, Mastrogiannis D, Antsygina T N and Chishko K A 2011 Relationship between electromagnetic and acoustic emissions during plastic deformation of gamma-irradiated LiF monocrystals *J. Appl. Phys.* **110** 024907

- Nitsan U 1977 Electromagnetic emission accompanying fracture of quartz-bearing rocks *Geophys.Res. Lett.* **4**(8) 333-337

- Rabinovitch A, Frid V and Bahat D 2001 Gutenberg-Richter-type relation for laboratory fractureinduced electromagnetic radiation *Phys. Rev. E* **65** 011401

- Miroshnichenko, M. and Kuksenko, V. (1980). Study of electromagnetic pulses in initiation of cracks in solid dielectrics. *Soviet Physics-Solid State* **22**: 895-896.

- Warwick, J.W., Stoker, C. and Meyer, T.R. (1982). Radio emission associated with rock fracture: Possible application to the great Chilean earthquake of May 22, 1960, *J. Geophys. Res.* **87**: 2851-2859.

- O'Keefe, S. G. and Thiel, D. V. (1995). A mechanism for the production of electromagnetic radiation during fracture of brittle materials. *Phys. Earth Planet. Inter.* **89**: 127-135.

- Scott, D.F., Williams, T. J. and Knoll, S.J. (2004). Investigation of electromagnetic Emissions in a deep underground mine. *Proc. of the 23rd Int. Conf. on Ground Control in Mining*, Morgantown, 3-5 August 2004, 125-132.

- Frid,V., Rabinovitch, A. and Bahat, D. (2003). Fracture induced electromagnetic radiation. *J. of Phys. D* **36**: 1620-1628.

- Rabinovitch, A., Frid, V. and Bahat, D. (2007). Surface oscillations. A possible source of fracture induced electromagnetic oscillations. *Tectonophysics* **431**: 15-21.