GYPSUM AND QUARTZ SPECIMENS IN COMPRESSION FAILURE: FRACTO-EMISSIONS AND RELATED STOICHIOMETRIC BALANCES

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Abstract

Extensive experimental investigations were conducted on Gypsum and Quartz compression specimens of different sizes. They were brought to complete failure, showing two different failure modalities: (1) Very brittle loading drop for micro-crystalline Gypsum and Quartz; (2) Strain-softening behaviour for macro-crystalline Gypsum. All the tested specimens emitted acoustic and electromagnetic waves and the single events cumulated up to the peak load (Figs.1,2). On the other hand, neutron emissions were evident only for the largest specimens, which are more brittle than the smaller ones [1-4]. The significant chemical composition changes occurred on the fracture surfaces are consistently explainable by the assumption of Low-energy Nuclear Reactions (LENR), both fusion and fission reactions [5-7]. It is the first time that fusion reactions emerge, whereas fission reactions have already explained the results related to other materials like the iron-rich natural rocks [5]. Let us observe that, in the case of macro-crystalline Gypsum, an original correlation seems to appear between mechanical behaviour (strain-softening) and LENR modalities (multi-body fusion reactions).

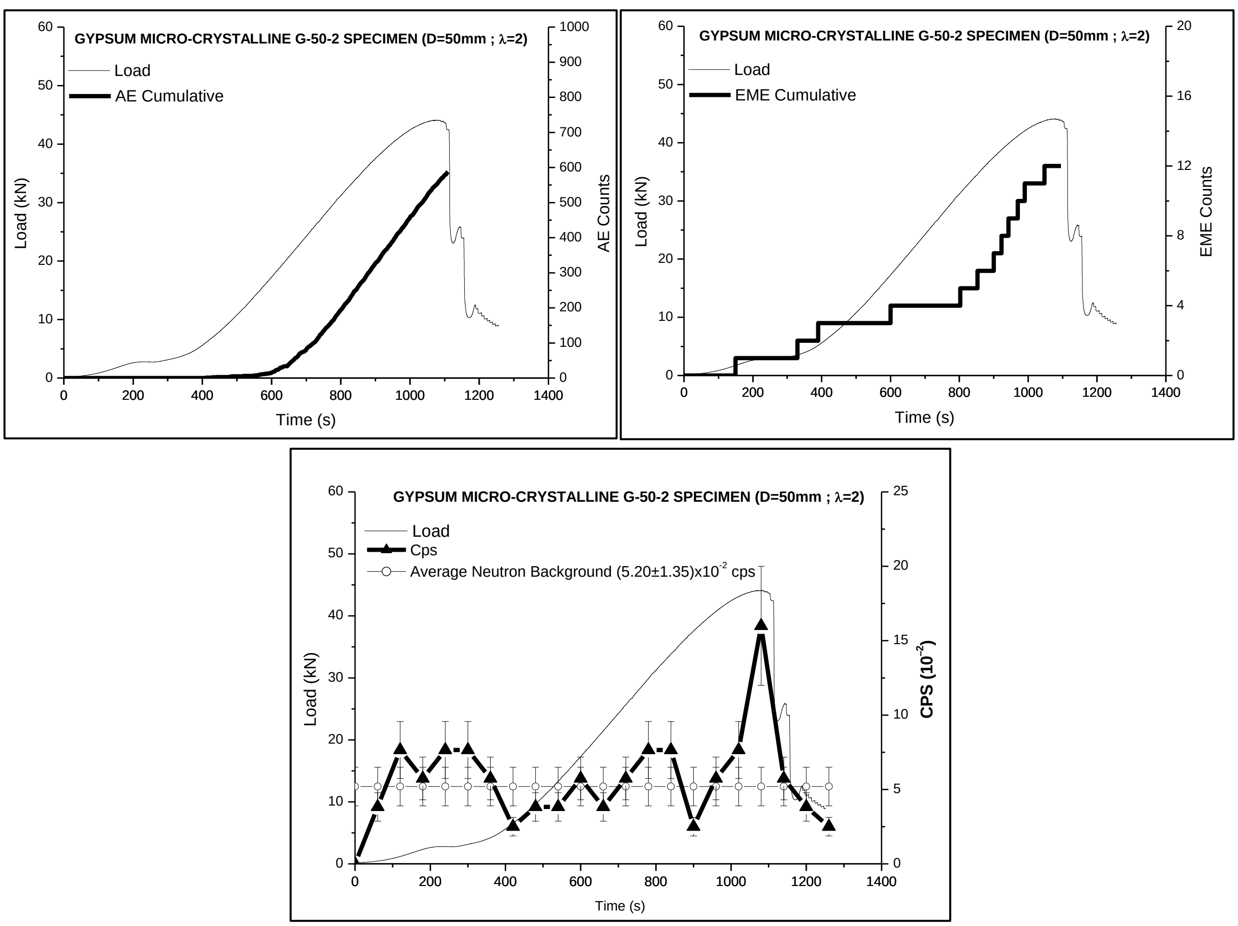

Figure 1. Load vs. time diagram of the Gypsum micro-crystalline specimen (G-50-2.0): Cumulated number of AEs (up); Cumulated number of EMEs (middle); NE count rate (down).

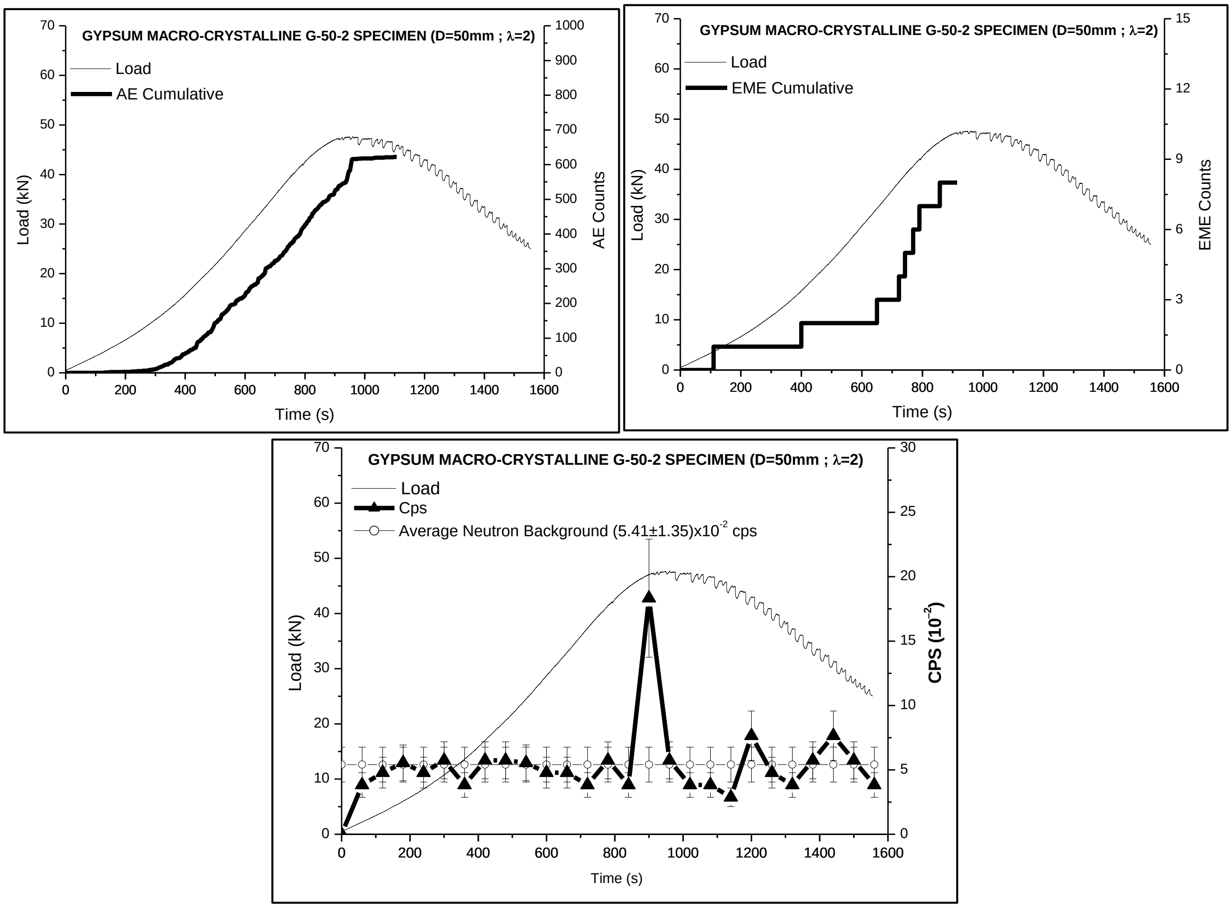

Figure 2. Load vs. time diagram of the Gypsum macro-crystalline specimen (G-50-2.0): Cumulated number of AEs (up); Cumulated number of EMEs (middle); NE count rate (down).

References

[1] Carpinteri A, Lacidogna G, Manuello A and Borla O (2011). Energy emissions from brittle fracture: Neutron measurements and geological evidences of piezonuclear reactions. *Strength, Fracture and Complexity* 7:13-31.

[2] Carpinteri A and Borla O (2017). Fracto-emissions as seismic precursors. *Engineering Fracture Mechanics* 177:239-250.

[3] Carpinteri A and Borla O (2018). Nano-scale fracture phenomena and TeraHertz pressure waves as the fundamental reasons for geochemical evolution. Strength, *Fracture and Complexity* 11:149-168.

[4] Carpinteri A and Borla O (2019). Acoustic, electromagnetic, and neutron emissions as seismic precursors: The lunar periodicity of low-magnitude seismic swarms. *Engineering Fracture Mechanics* 210:29-41.

[5] Lucia U and Carpinteri A (2015). GeV plasmons and spalling neutrons from crushing of iron-rich natural rocks. *Chemical Physics Letters* 640:112-114.

[6] Carpinteri A, Lucia U, Zucchetti M and Borla O (2022). THz vibrations and phono-fission reactions from crushing of iron-rich natural rocks. *Journal of Condensed Matter Nuclear Science* In press.

[7] Carpinteri A, Borla O and Manuello A (2022). Hydrogen embrittlement, microcracking, and THz vibrations in the metal electrodes of cold-fusion electrolysis experiments: Repeatability of nuclear and stoichiometric balances. *Journal of Condensed Matter Nuclear Science* In press.