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3P37 - Electric breakdown in granite as a function of pressure and temperature conditions

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It is widely accepted that the breakdown field in fluid (water) is affected by the duration of the applied voltage. Consequently, when a solid (rock) is submersed into a fluid and placed between electrodes, a breakdown occurs in the solid dielectric rather than in the insulating liquid depending on the voltage-time characteristics and on the values of the electric field: there is competition between the dielectric strength of the two mediums.
Many experiments have been performed to determine the behavior of voltage-time characteristics of the discharge in fluids and solids at room temperature and atmospheric pressure. In these conditions, to be sure to generate the breakdown in the rock, the voltage pulse must be shorter than one microsecond and the applied electric field must reach at least 100 kV / cm.

This paper presents the dielectric strength test results of a 3mm point-to-point marble gap submersed in tap water at varying temperatures (from 20℃ to 100℃) and static pressures (from 1 bar to 200 bar). In order to minimize the volume of the energy bank, the switching energy is limited to 50J.
Typical records of the current discharge and the applied voltage will be analyzed. The required energy consumption to initiate the breakdown in the rock will also be exposed. Those results will be associated to electric field simulations: the breakdown field distribution into the rock will be studied as a function of thermodynamic conditions.

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