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Measurement of crack velocity by inducedelectromagnetic radiation

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Electromagnetic radiation (EMR) emanating from fracture has been an extensively investigated phenomena in recent years. It was measured in the lab for fractures of various materials, including glass, metals, alloys, rocks and ice. EMR is also associated with various applications: collapse prediction in mines, blasting control in quarries, evaluation of stress directions in situ and monitoring of volcanic eruptions. Many EMR measurements were also carried out in connection with the problem of earthquake monitoring.

In the only viable EMR model, developed by our group, it is assumed that following the breaking of bonds by the moving fracture, positive charges move together in a diametrically opposite phase to the negative ones while decaying exponentially into the material, like Rayleigh waves. This model enabled us to obtain correlation between crack sizes and EMR pulse parameters. Moreover, our EMR model predicts that crack velocity should be proportional to the EMR amplitude. However no actual proof of EMR use for crack velocity evaluation has hitherto been provided. In the present work we compare crack velocity evaluated by both the Wallner line method and EMR. Results show that the correlation coefficient of the regression line between the EMR peak amplitude and the crack velocity calculated by the Wallner line method is R^2=0.96. Hence, our results indicate that the use of EMR peak amplitudes as a measure of relative crack velocities can be a useful procedure.