A probabilistic model for the erosion of cement-based composites due to very high-speed hydro-abrasive flow

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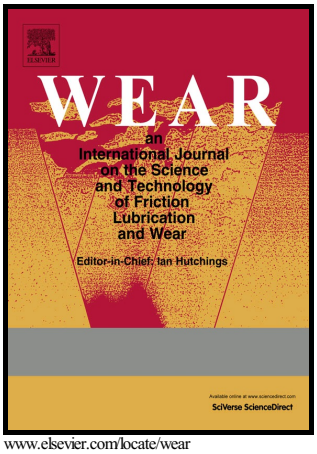

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A probabilistic model for the erosion of cement-based composites due to very high-speed hydro-abrasive flow

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Abstract

A probabilistic model $\dot{V}_M \propto 1-\exp[-z\cdot(\sigma_T/\sigma_C)^m]$, originally developed for comminution processes, is applied to cement-based materials, eroded by water-driven abrasive particles with velocities as high as 552 m/s. In the equation, $\dot{V}_M$ is the volumetric erosion rate, and the ratio σ_T/σ_C is the dimensionless impact stress (tensile stress/compressive strength). Based on experimental investigations, values for the scale parameter (z) and the shape parameter (m) are estimated for five cement-based materials. Results of Spearman's rank coefficient calculations show that the scale parameter is particularly sensitive to the compressive strength, and this effect is explained through higher flaw densities in low-strength materials.

1. Introduction and model approach

Demolition, cutting and separation of reinforced structures are major parts of repair, recycling and decommissioning processes. The utilization of stream-line tools, which are characterized by high local energy input, for these applications is a promising strategy. Approaches for the implementation of such a cutting strategy include the use of hydro-abrasive cutting tools [1-4]. Erosion, as a material removal mechanism, is actually the generation of a number of chips, or debris. Shape and size of the debris depend on numerous process and material