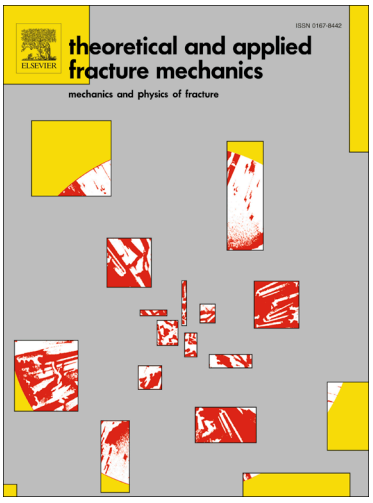


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# Influence of Grain Size on Granite Strength and Toughness with Reliability Specified by Normal Distribution

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**Abstract**: This study presents a simple fracture model linking average grain size $G$ of granite to tensile strength $f_t$ and fracture toughness $K_{IC}$. This model only requires the peak load $P_{max}$ measurements of small notched samples to determine both $f_t$ and $K_{IC}$. The influence of $G$ was considered for: (i) quasi-stable crack growth before $P_{max}$, and (ii) fracture transition from $f_t$ to $K_{IC}$ criterion. In-depth analysis was carried out on three-point-bending (3-p-b) results from granite with $G \approx 2.5$ mm. The 3-p-b specimens have two different beam widths $W$ = 30 and 70 mm, and the same span/width ratio $S/W$ of 4. Another granite with $G \approx 10$ mm reported in literature was also analysed to show the influence of different grain size on both $f_t$ and $K_{IC}$. Comprehensive data on rock fracture are explained and compared with the results of this study to substantiate findings of this study. Experimental scatters in $P_{max}$ with different initial notch lengths $a_0$ = 0 – 53 mm were analysed by normal distribution, following a recent study [Zhang et al., 2018]. The new model with normal distribution predicted the mean and upper and lower limits with 96% reliability covering the experimental scatters.

**Keywords**: Fracture toughness; Polycrystalline material; Granite; Probability and statistic; Size effect