



## **The theoretical model for combined sample size and strain rate effect on tensile strength of quasi-brittle materials**

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### **Abstract**

Under external loads, tensile strength of quasi-brittle materials, such as rock and concrete, exhibits size and strain rate effects. Experiments have shown that the size effect and strain rate effect interact with each other. Based on the fact that the strength of solid material is the superposition of the thermal activation strength component under quasi-static loading and the macroscopic viscous component under dynamic loading, by using the static size effect laws of tensile strength, the thermal activation theory of material deformation and failure, Weibull's model of random local strength of materials and crack dynamics, theoretical model for the combined sample size and strain rate effect on tensile strength of quasi-brittle materials is established, which cover wide strain rate ranging from low strain to high strain rate. The theoretical model is validated by comparing its prediction with experimental data. Finally, the weakening effect of strain rate on material strength at high strain rate is incorporated into the proposed model. The developed here theoretical model provides the better understanding of the combined sample size and strain rate effect on tensile strength of quasi-brittle materials.

### **Keywords**

Quasi-brittle materials; strain rate; Weibull's model