

Stress Intensity Factor

The stress near the tip of a crack is higher than the nominal stress σ , calculated as though no crack existed. Advanced mathematical stress analysis leads to the conclusion that the following combination of stress σ and crack length a should be a material property.

$$K = \sigma\sqrt{\pi a}$$

Here, a is the length of a crack from the surface; $2a$ is the length of a totally enclosed interior crack. K is called the *stress intensity factor*. Fracture is predicted to occur when:

$$K = K_c$$

with K_c being the critical stress intensity material property. K_c is also known as the *fracture toughness*. This property has the unusual units of (force)•(length)^{-3/2} or (pressure)•√(length). A geometrical factor is sometimes required in the definition of K to account for different geometries, though for several common cases, its numerical value is close to 1.