The stress intensity factor, K, serves as a description of the stress field around a crack tip in terms of the size of the crack, 2 a, the applied stress σ, and a geometric factor, Y

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

The fracture toughness K_c largest value of stress intensity for which the crack is stable. So if sc is the critical driving stress, and a the /12 crack length,

$$K_c = \sigma_c Y \sqrt{\pi a}$$

The fracture toughness is not a material property since it depends on the specimen thickness, all other things being equal.

The fracture toughness decreases as the specimen thickness increases and we get closer to plain strain. Finally it levels off and is no longer dependent on the specimen thickness. At this point it is considered a material property, which is the plane strain fracture toughness, K_{Ic}.