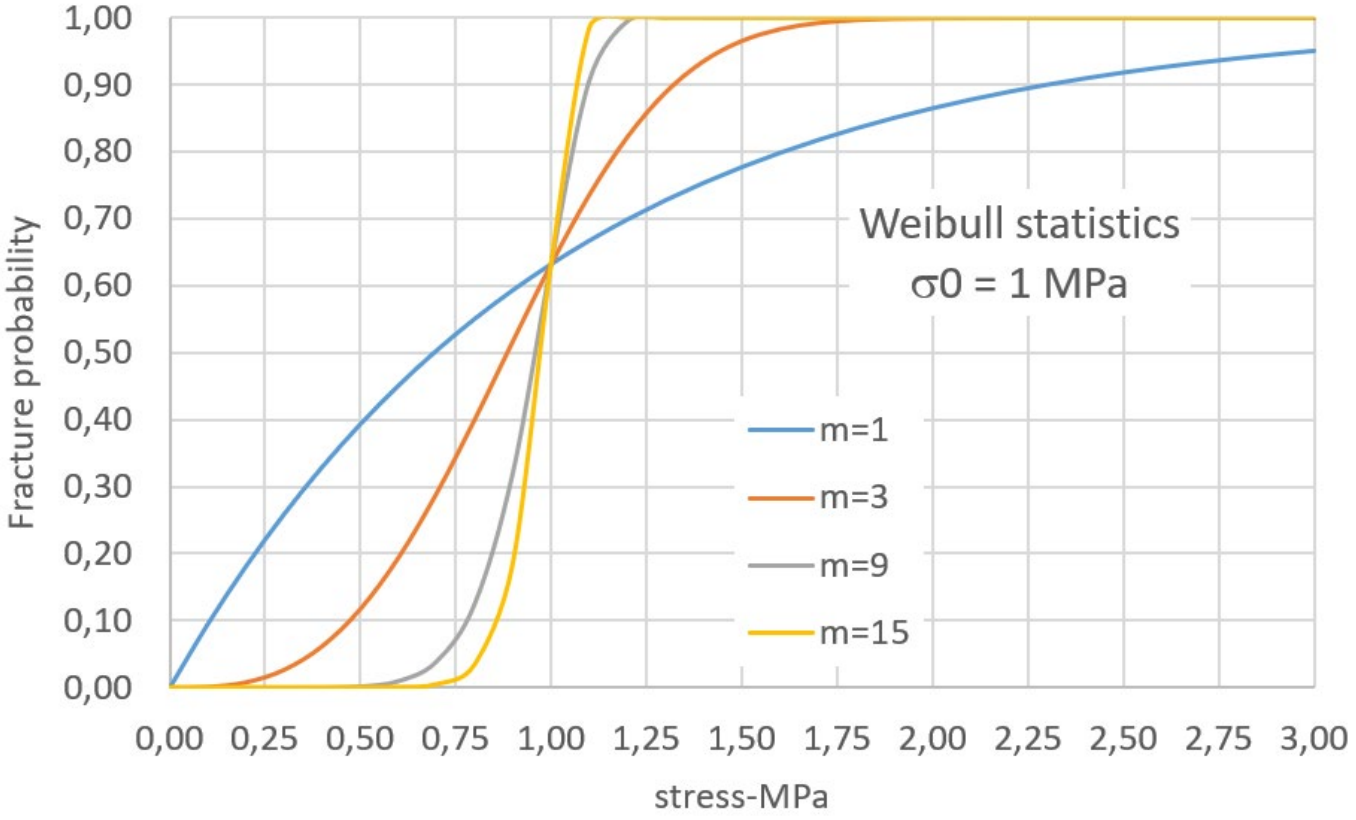
Weibull statistics



Prof. Drezet/Molinari

Weibull statistics

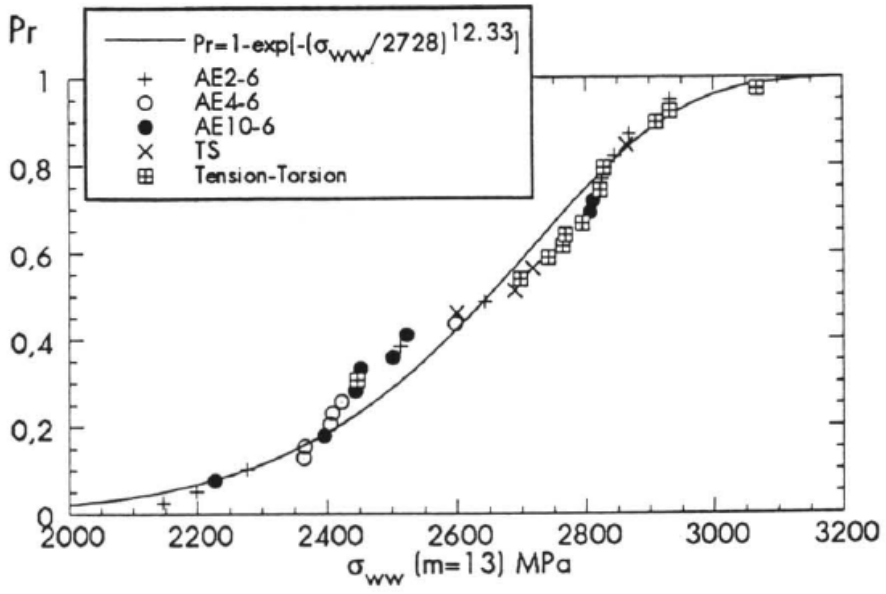


Figure 5. – Probability to failure as a function of Weibull stress for the case of intergranular fracture. Tests on smooth and on notched (AE) specimens.

C-Mn-Ni-Mo steels

Using this modified expression for the Weibull stress, it was found (*fig. 5*) that the Weibull theory accounts very well for the results obtained on different specimen geometries, including thin tubes under tension-torsion loading. The value of m ~ 13 for the Weibull shape factor is much smaller than the value (typically ~22) found for cleavage fracture, reflecting the larger scatter found for the case of intergranular fracture.

Short crack effects in fracture and fatigue

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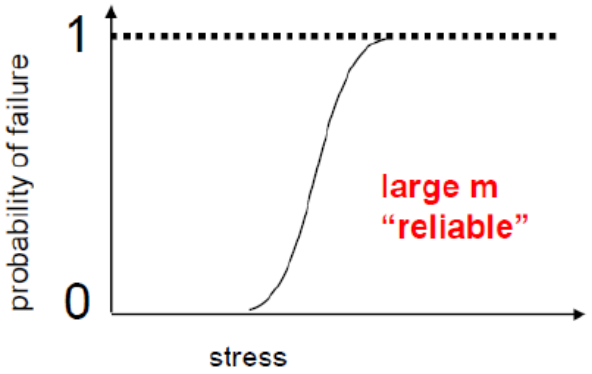
Metallurgical and Research Technology, volume 92 / No 2 (feb. 1995).

m and reliability

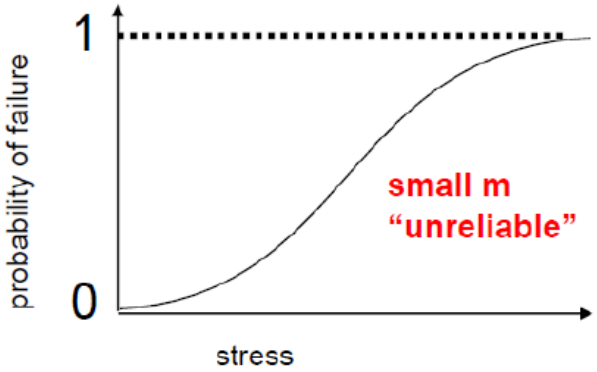
- **large m:**
  narrow distribution, small spread
  ➔ reliable material

- "tough" ceramic components:
  m = 10-40



- **small m:**
  wide distribution, large spread
  ➔ unreliable material

- "bad" ceramic components:
  m = 1-10



3-point and 4-point bend tests

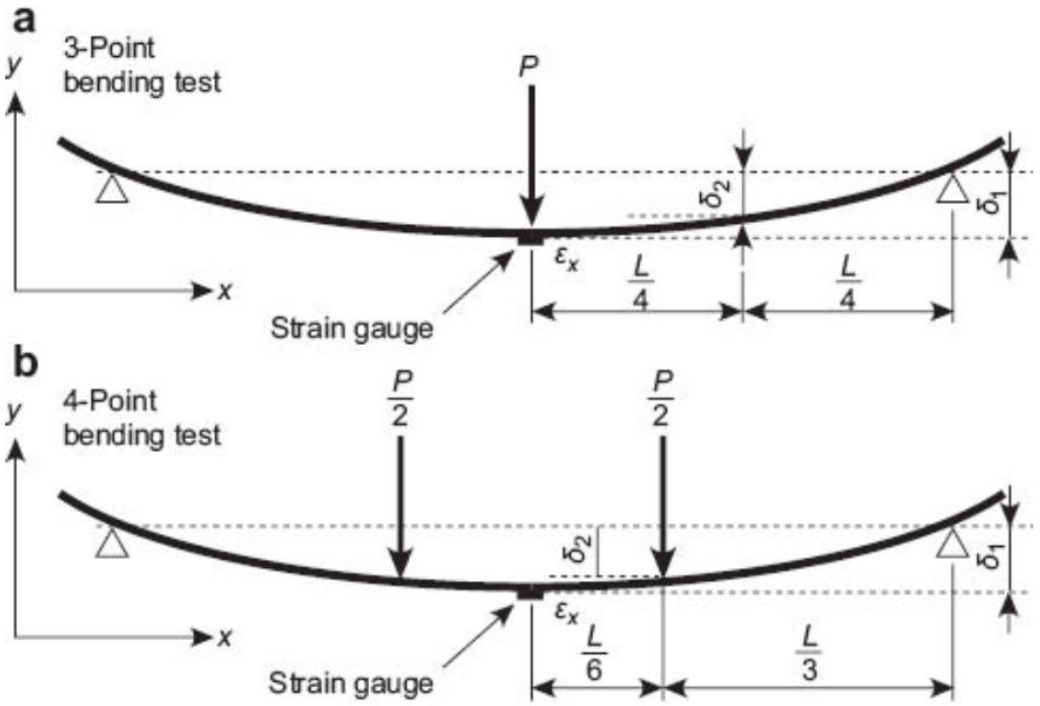
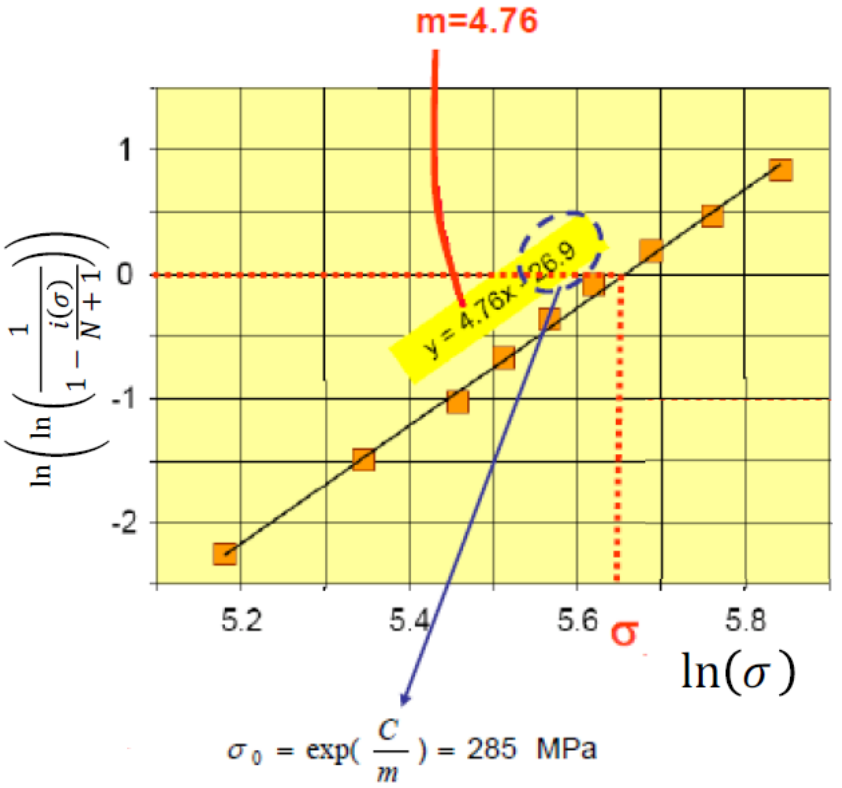


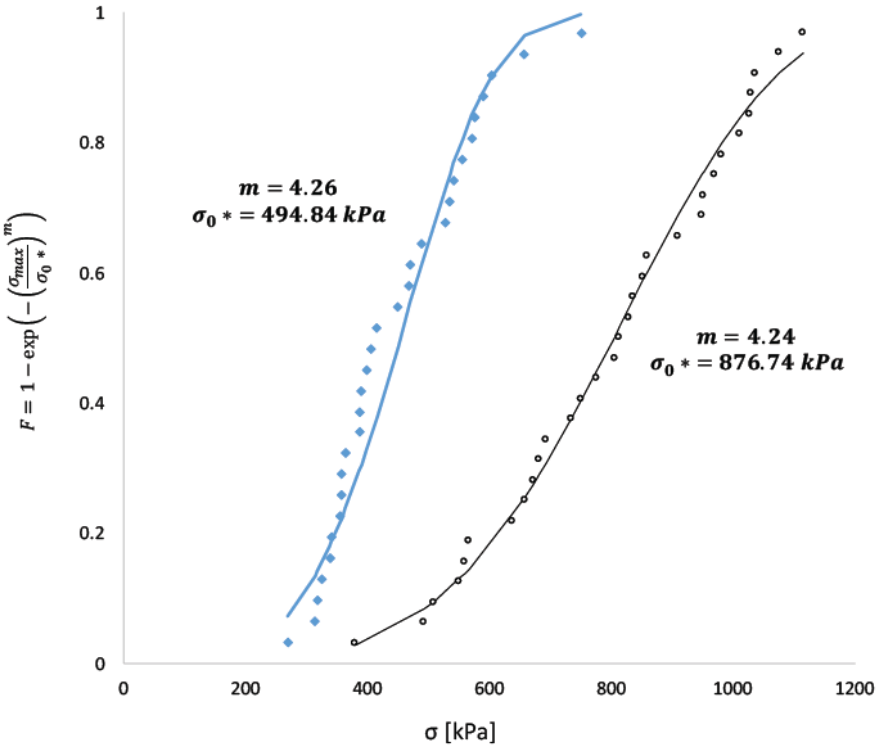
Figure 3-2. Three- and four-point bending; here the inner span L_i equals one-third of the outer span L_o (a situation referred to as "loads at third points").

Tensile data for ground glass with N = 9

Test No.	Failure strength (MPa)	Rank	Failure strength (MPa)	Failure probability $F(\sigma) = i/(N+1)$
1	178	1	178	0.1
2	276	2	210	0.2
3	262	3	235	0.3
4	296	4	248	0.4
5	210	5	262	0.5
6	248	6	276	0.6
7	235	7	296	0.7
8	318	8	318	0.8
9	345	9	345	0.9



Bend tests of solid fat at two loading speeds (N = 30)



Fit of the two-parameter Weibull distribution (solid curves) to estimates of $F(\sigma)$ from 30 four-point bend specimens of palm kernel oil (a solid fat) tested at 0.01 mm/s (crosses) and 23 °C and at 10 mm/s and 23 ° (circles). The corresponding values of m and σ_0^* are given in each case, where $\sigma_0^* = \sigma_0/k_m^{1/m}$.