



Two halves of the fracture surface of an aluminum fatigue failure. Loading was from zero to tension ($\sigma_m > 0$). The circled areas are where fatigue cracks initiated and slowly propagated each load cycle until the crack became “unstable” – meaning the crack within in very few (perhaps 1 single load cycle) propagated along the remaining cross-section. Arrows indicate probable location of crack initiation. A crack becomes unstable when it reaches a critical length; less material remains the longer the crack becomes and also the stress intensity (stress concentration) is greater for longer cracks. Looking closely at the fatigue fracture surface one can see “beach marks” – macroscopic semicircular features characteristic of fatigue. (photo credit: Peter Chamberlain and Maddy Sickler).

Fatigue failure from a fork-lift upright. Fatigue crack initiated from an *interior* defect in the casting. Fatigue beach marks are evident within the circled area (the crack grew slowly each time the load was applied) and outside the circled area the brittle fracture grew in a single overload resulting in a broken part.

