

CATEGORY: **NECK BREAKAGE**

TYPE: **INSTANTANEOUS - MATERIAL QUALITY  
(DEEP SEATED DEFECT "DSD")**

### CHARACTERISTICS

Instantaneous neck breakage resulting from a deep seated defect typically occurs along the transverse plane. The fracture face can be characterized by fracture flow lines originating from a single interior point. Close examination of the fracture origin will not reveal any evidence of fatigue (fatigue arrest marks), indicating that cracking did not occur over a period of time, but occurred instantaneously.

### EXAMPLES



#### EXAMPLE 1

Fracture face of a neck that broke instantaneously as a result of a deep seated defect. Arrow highlights the fracture initiation site.

## MECHANISM

During solidification, it is possible for an irregularity to become “entrapped” within the ingot. This irregularity can be anything from refractory, slag, localized segregation, porosity etc. These irregularities can then act as stress concentration factors when the roll is put into service. When the localized stress induced during rolling at subsurface stress concentration sites exceeds the tensile strength of the material, crack initiation and propagation will occur instantaneously. The loads required to exceed the tensile strength of the material are large compared to those required to exceed the fatigue strength. Therefore, a mill related incident where the typical rolling pressure applied to the neck is exceeded is usually required for fracture to occur in an instantaneous manner from a deep seated defect. It is more likely that under typical rolling conditions, fatigue fracture would occur before instantaneous fracture.

## PREVENTION

Instantaneous neck breakage resulting from a sub-surface stress concentration factor can be prevented by the following:

- Identification and control of critical melting variables by the roll manufacturer to reduce the possibility of an irregularity existing in the ingot after solidification.
- Avoid mill related incidents that result in a large increase in the pressure applied to the roll necks.
- Increase the material strength of the neck through a change in the pre-hardening heat treatment.