Rod structure of a variety of thread used over a period of time under different working conditions and stress state, will eventually lead to the failure of drill rods. Rod failure is generally divided into normal failure and non-normal failure. The normal lapse divided into the fatigue fracture failures and wear failure. The abnormal failure is early brittle fracture or non-fatigue brittle fracture. Drilling process card brazing could not pull the card brazing blasting fried bends or improper operation and so on are not normal fracture scrapped, and does not belong to the scope of this article.

Threaded Rod failure is part of the general in the transition zone of the threaded parts, rod and threaded rod (commonly known as the process slot). To sum up, the failure modes of: the three failure modes of the threaded parts within fatigue outer fatigue and outer surface wear; outside of the transition slot fatigue, within the fatigue two failure forms; rod outer Fatigue, within the fatigue and the outer surface of wear Three failure form.

Abnormal early brittle fracture or non-fatigue brittle fracture failure in the rod transition slot and threaded parts are likely to produce.

Threaded Rod the normal failure analysis and mechanism

As mentioned earlier, the main thread Rod cyclic stress, so by the high-frequency tension and compression, threaded Rod normal failure should fatigue failure.

The 1.1 threaded part of the outer fatigue failure and mechanism

Rod threaded coupling sleeve threaded coupling, both then were to join the solder tail thread and drill head screw, constitute a combination of brazing with. When the thread is tightened, the gap still exists between the threaded. Under high impact effect between the internal and external threads to generate high frequency impact, mutually sliding friction generated in the contact point (line or surface), and thus produce heat. The the heat bad hyperthermia speed is greater than the cooling speed, the contact area will soften or reduce the hardness to accelerate the wear of the contact point, the formation of the wear pit. Continuing role in the high-frequency impact stress, causing stress concentration, fatigue source in the pit of wear of the maximum stress concentration, followed by fatigue source of expansion, the formation of fatigue cracks, eventually leading to the failure of the drill rod.

Threaded coupling sleeve contact at Rod also due to high fever and a cold solder joints burning that ablation pit individual even to the degree of metal melting and the formation of the melt pits easier formation of these ablation the pit or melting pits fatigue Rod source and cause failure.

1.2 Threaded Rod threaded parts of fretting wear, the shocks wear and abrasion
failure

When the heat better conditions (such as wet drilling) or between the internal and external threads the gap is small, not easy to produce high fever, high frequency shock stress between the thread will show reciprocating sliding state, resulting in the fretting wear, that is, two occurs between the surface of the wear caused by the small-amplitude vibration phenomena.

When Rod hardness not have enough toughness fretting wear rate will speed up, sometimes even more than fatigue initiation speed. That is, on the one hand, the threads of low hardness, fretting wear fast; On the other hand, the material has adequate toughness and ductility, notch stress concentration can reduce the stress field of energy, delay notch stress concentration changes to the fatigue source, but also can reduce the the fatigue source or the fatigue crack tip stress field of energy, reducing the fatigue source formation rate and the fatigue crack propagation rate, slow down the process of fatigue fracture. So there will be a phenomenon of fretting wear causes the thread can not afford to join the role (tripping) failure.

In addition, with the increase of the amount of wear, the gap between the yin and yang thread has also increased, so that the rotational force of the drilling machine can not tighten the thread in the drilling process, the coupling sleeve obvious string action, and coupling sleeve and the drill rod occurs The impact between. The impact of such a collision on the thread surface wear than simple reciprocating small amplitude sliding (ie fretting wear) is much more serious, sometimes nearly a hundred times higher. This is caused by another drill rod thread wear failure mechanism.

1.3 threaded drill rod outer transition slot fatigue fracture

The transition slot outer fatigue fracture ratio within the fatigue fracture rate is high. Because, the smallest diameter of the transition groove, is smaller than the diameter of the rod body and the thread diameter. In the rock drilling process, the transition groove in the position of the beam, so the largest bending stress suffered, particularly close to the one end of the drilling machine is a horizontal operating. The transition trough outside fatigue fracture often appear in this area.

The mechanism of fatigue fracture in the transition groove that is: in the rock drilling process, the subject of the transition groove behind the threaded parts of the high-frequency pull compressive stress, in addition to the maximum bending stress caused by various situations when the drill rod deadweight and Drilling in the the transition trough the outer surface of microscopic defects (such as coarse grain of turning tools and other surface damage) caused by stress concentration, microscopic defects gradual formation of fatigue source, and the development of a fatigue crack.
Fatigue crack under the combined effect of the high frequency tension and compression and bending stresses expansion faster, and ultimately lead to the transition slots remaining cross section can not be exposed to external stress and fracture. Drill rod is rotated in the drilling process, so it is often found that the the transition slots fracture fatigue source or fatigue cracks are multiple.

1.4 Threaded Rod within the fatigue failure and mechanism

Threaded Rod within Fatigue Fracture including internal fatigue failure of the three parts of the thread, transition slot and lever body, and its failure mechanisms belong to the same stress corrosion fatigue fracture (wet drilling) mechanism or notch stress concentration fatigue fracture mechanism (dry chisel rock).

Wet drilling stress corrosion fatigue fracture mechanism: The Arbors Rod drills, drill rod or underground work and partly open to the Arbors Rod widely used wet drilling, mineral water is neutral, acidic or alkaline, Rod corrosive effect, especially in the high frequency stress, the hole in the threaded parts suffered stress increase the transition groove at the inner hole, followed by, and the stress of the lever body holes relative minimum. So, the inner hole at the high stress will be the first to stress corrosion. The greater the stress, stress corrosion, the higher the speed, gradually formed at the high stress corrosion pits. The corrosion pits would cause the emergence of stress concentration, and accelerate the development of corrosion pits and the formation of fatigue cracks. Corrosion and stress concentration and promote each other, and to accelerate the fatigue crack propagation, and ultimately lead to stress corrosion fatigue fracture, shortening the life of the thread Rod.

Dry-rock drilling notch stress concentration fatigue fracture mechanism: a lot of open-air ground rod drilling operations orifice catching dust dry drilling. Rod Rod inner hole high stress areas of microscopic defects or non-obvious metallurgical defects in high-stress areas at high frequency shock stress, stress concentration. The stress concentration will be exacerbated by the passage of time with work, the above microscopic defects or metallurgical defects which are formed to fatigue source under a continuing role in the stress concentration, fatigue source extended to fatigue crack, eventually leading to fatigue fracture. Below the dry fatigue strength due to corrosion fatigue strength of steel, wet drilling Rod life is lower than the dry rock drill, drill rod life.

The failure and the mechanism of the body of the 1.5 thread brazing club

Threaded rod Rod, maximum diameter, relative to the threaded parts and transition trough its minimize stress, and is not reasonably likely to fail. However, the lever body is generally not machined to retain hollow steel original defect, but also partially of the drill rod forging heating or local heat treatment, heating defects often bring to the lever body and the transition zone in the heating caused by
metallurgical notch. These defects increase the weak link of the rod, the possible formation of the fatigue source and the fatigue crack growth defects at earlier, Rod advance fracture. This is the main reason for the failure of the rod. The rod in the drilling process is also affected by the wear of rock and debris, often the rod diameter is significantly reduced or hexagonal rod is ground into round, but wear worn away the source of fatigue microcrack reduced fatigue crack formation and development, therefore, does not affect the continued use of the drill rod, generally do not cause the failure of the drill rod.

2 Threaded Rod early failure

Threaded Rod early failure often appear in the actual drilling, non-fatigue brittle fracture and short life of its main manifestations. When the material plasticity poor, made brazing process (including forging, heat treatment, machining, etc.) properly, drill rod structure is irrational, and improper operation of the drilling are likely to result in early failure. The site of failure is often the biggest force threaded parts or transition slot. Also generated in the rod when the rod serious defects brittle fracture randomness. The most obvious features of brittle fracture is not observed fatigue crack fracture neatly the porcelain-shaped fracture, irregular dark gray rough-shaped fracture. The former is the hardness is too high, latter is forging heating hot or burning brittle fracture. Sometimes also found traces of plastic deformation is not flush with the fracture, often irrational structure (if any sharp corners, inner hole is too large or the transition groove diameter too small), caused by overload or processing defects. Rod early failures directly reflect the ratio of the size of the timber-producing factory, made brazing plants and even the level of department.