

# Research on the Cause Analysis and Application of Monitoring Technology of Damping Body Deformation in Tailings Reservoir

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**Keywords:** Tailings dam; deformation cause; monitoring technology; application

**Abstract:** The deformation of the tailings dam body is one of the common ore body deformations. The main influencing factors include the position of the dam itself, physical properties, and local hydrological conditions. Through the deformation mechanism, the cause of the deformation of the tailings dam body and the application of monitoring technology are explained.

## 1. Introduction

After the ore body is mined, the site where the residual slag remains is the tailings pond. After years of mining, the number of tailings ponds in China is huge. Generally, the tailings dam body is mainly for upstream dam construction with poor stability, which has a large safety hazard. To ensure the safety of the tailings pond dam, it should be checked and closed and other protected according to the degree of danger of the ore body. Especially for new dams, it is necessary to ensure that they meet the relevant standards before they can be opened.

## 2. Deformation law of tailings accumulation dam

The deformation of tailings accumulation dam has certain regularity, including its spatial distribution and deformation mechanism. The following is an analysis of the treatment of the upstream dam body tailings accumulation.

The tailings accumulation dam is deformed from bottom to top, and the direction is perpendicular to the dam axis. As the thickness of the mine increases, the absolute settlement value and settlement rate of the dam surface increase. That is to say, the settlement deformation of the tailings accumulation dam depends on the thickness of the tailings. Generally, we believe that the thicker the tailings, the faster the settlement, the larger the settlement, and vice versa. The horizontal displacement of tailings depends on the amount of vertical deformation. After the vertical deformation increases, the amount of change and the rate of change of the horizontal displacement of the dam are larger. However, in the influence of the ore control of the dam, the horizontal displacement of some parts is negative. It is proved that the horizontal displacement is not only affected by the vertical velocity, but also directly related to the slope effect. The slope slope assembly gradually increases the deformation of the tailings dam from top to bottom. When the load on the upper part of the dam changes, it will cause partial distortion of the ore body, that is, vertical deformation to the sinking of the tailings. The space of the tailings accumulation dam - the vertical distribution is dominant, and the horizontal deformation is supplemented.

The tailings dam accumulation process is related to the settlement time. With the continuous settlement of the ore body, the settlement value of the tailings dam will be reduced to a certain extent, and the settlement speed will also decrease. The settlement value at the same observation point will gradually decrease. The settlement center will also gradually increase with the accumulation thickness of the dam, and the lower part of the dam will be more stable, thus reducing the settlement speed. The horizontal displacement is mainly affected by the plane environment. During the rainy season, the decline and deformation speed of the tailings dam usually become larger. With the end of the rainy season, the wetting line in the tailings dam decreases and the seepage pressure decreases, which will cause a certain degree of horizontal displacement and rate reduction.

### **3. The deformation mechanism analysis**

The tailings deposit is an under-consolidated soil layer, and once it is not consolidated, sedimentation and deformation will occur. Therefore, when controlling the tailings treatment, consolidation and compaction must be performed. Understanding the deformation mechanism is the main problem, including the ore body compressibility and consolidation.

Tailings are three-phase bodies. The compression of water in the pores, the reduction of voids and the compression of tailings particles are the main forms of their main compression. Among them, the main compression deformation is that the voids become smaller. With the deposition and deformation of the tailings, air and water are continuously discharged in the voids of the dam. The physical compression of the tailings is affected by the physical properties of the ore body. When the sediment density of the tailings body is large or the void ratio of the tailings mud is increased, the compression is large, and the ore body is soft. Generally, the softer the ore body, the easier it is to be compressed. The soft ore body has the characteristics of obvious water chestnut and soft soil. Compared with natural soil, the ore body has stronger compressibility. Among them, in this study, the deformation of the tailings dam body is affected by the soil quality. Because of the high clay content in the tail of the ore body, the compressibility and water permeability of the dam body are affected, and the tailings dam is achieved. The characteristics of settlement.

Consolidation is the main cause of sinking of tailings. Consolidation is the accumulation of dams caused by long-term deposition after construction or construction. The control of consolidation has the most direct relationship with the stability of the dam. He controls the foundation settlement of the tailings dam and the sedimentation rate of the ore body, which occupies an important position in the whole project. Among them, the consolidation stage is mainly composed of two stages: primary consolidation and secondary consolidation, and is dominated by primary consolidation. The main consolidation of the ore body occurs quickly and the deposition amount is large. The consolidation coefficient of tailings mud has something in common with natural soil. Under the action of the sum, the main consolidation occurs frequently, and a certain degree of voids is increased, and the ore bodies are re-arranged, and the ore body deformation occurs.

During the sedimentation process, the catastrophic geological environment will also affect its stability. When the ore body is affected by a bad environment, it will accelerate its vertical sinking speed and horizontal displacement speed. Taking the tailings dam of this study as an example, the main influencing condition is the deformation of the dam caused by lava. In addition, in the long-term construction process, the surrounding facilities will inevitably have the possibility of failure, and it will not be able to prevent the water leakage of the dam, and eventually cause the latter to horizontal displacement. Finally, it is believed that damage and erosion of surface water will cause changes in the geological environment.

### **4. The relationship between deformation and stability**

We can take the necessary measures by analyzing the relationship between the deformation and stability of the tailings body. In the process of dealing with this problem, the settlement and consolidation of tailings have a positive effect on the enhancement of their own performance. The settlement reduces the gap of the lower dam, and the settlement of the downstream dam is generally small. Through the above analysis, the amount of deposition in the middle of the dam is small and the ends are large. When the performance of sand is softer, the descending speed and deformation will be larger. We use it as the main basis for studying the deformation of tailings ore, and use informational positioning technology to control the deformation and ensure the stability of the tailings. Generally, after the tailings pond is closed, its stability will be guaranteed, but certain measures are still needed to prevent its huge drop or deformation. This study mainly uses GNSS (BDS/GPS) to solve the problem of tailings stability.

## 5. GNSS (BDS/GPS) dual system combination relative positioning technology

GPS technology is the best way to solve the problem of sinking and deformation of ore bodies. Due to the poor stability of the tailings, the dual-system satellite positioning technology is used to realize its monitoring process and ensure its safety. In the future, this technology will be further improved to broaden its scope of influence. At present, there has been a combination of BDS and GPS. This is more advanced, more stable and more continuous than a single GPS. The principle is to use the difference between the BDS and the GPS, so the positioning will be more precise than a single method. Therefore, the key issue of this technology is the fixed method of the ambiguity of the whole week in the relative positioning of the BDS/GPS combination. The mathematical model is the basic method in testing. GNSS (BDS/GPS) dual system

The system combines relative positioning technology and solves the problem of carrier phase double difference measurement. In this system, the software baseline setting module is used to realize the positioning function. As technology advances, more combinations of technologies will be used to complete the positioning. Only accurate positioning can further complete the analysis of the ore body, understand the factors affecting the sinking and consolidation of the tailings, and take corresponding measures to ensure the safety of the tailings. In the process of multiple studies, relying on BDS alone to solve the solution and static solution and two ways to improve the accuracy of the solution. However, in the process involved, only using the BDS system will reduce the positioning efficiency. With the wide application of the GPS system, the positioning effect of the tailings dam body is obviously improved. Under the combination of the two technologies, the tailings are well ensured. Stability.

## 6. Summary

The main cause of deformation and subsidence of the tailings dam is spatial distribution and time evolution. The importance of ensuring the stability of the tailings dam is illustrated by an analysis of the two causes. Finally, it is proposed to use GNSS (BDS / GPS) dual system combined relative positioning technology to systematically deform and sink control detection. After the ore body is mined, the site where the residual slag remains is the tailings pond. The stability of tailings has a great impact on the safety of ore bodies in China. GPS technology is one of the best means to solve the subsidence and deformation monitoring of ore bodies. The combination of BDS and GPS technologies and the combination of various technologies will become the monitoring method for the deformation of tailings dams in the future.

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