Analysis on the Properties of Modified Steel Slag Asphalt Mixture

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Abstract. steel slag property reform is the main form of comprehensive utilization of industrial waste resources. Therefore, this paper combines the theory of steel slag surface modification technology, focusing on the expansion characteristics, aggregate effect and other aspects, to explore the performance of modified steel slag asphalt mixture, in order to achieve clear technical points, to achieve the purpose of comprehensive development and application of social resources.

Keywords: Steel Slag Surface Modification Technology, Asphalt Mixture, Performance Analysis

1. Introduction
Steel slag is an industrial solid waste, it is the steel slag discharged in the process of iron and steel smelting, mainly composed of calcium, iron, silicon, aluminum, manganese and other oxides. In order to reduce the material loss in industrial production and improve the utilization rate of waste resources, we should combine the basic characteristics of materials to realize the optimal utilization of development resources.

2. Steel Slag Surface Modification Process
Iron, manganese and other oxidizing elements in steel slag are mainly gray and dark brown, because they contain a large amount of free calcium and magnesium oxides, which are converted into hydroxides when they react with moisture, and then the slag volume expands and breaks down. The secondary utilization value of this resource is low [1]. Therefore, the surface of steel slag is simply treated to increase the stability of steel slag structure, improve the utilization rate of resources, and realize the practical effect of comprehensive treatment of steel slag resources. Combined with related fabrics, the key points of surface modification of steel slag can be summarized as follows:

2.1 Selection of Surface Modification Methods
At present, the surface modification methods of steel slag mainly include spray, mixing and soaking. The so-called spray modification is to collect the modified auxiliary raw materials into the surface of the object by aerosol spraying to increase the stability of the surface structure of steel slag. Because the modified materials sprayed by aerosol spraying are limited, if the surface pores of the material are more and the outburst is uneven, it often cannot meet the need of complete coverage of the surface of
steel slag material. Therefore, this method is more suitable for materials with flat surface and relatively few pores. Mixing modification refers to the modification of steel slag surface by percentage mixing combined with the basic characteristics of modified materials. This method can maximize the distribution of steel slag pores and concentrate on the surface layer to change the performance. For example, large-scale steel slag needs surface modification adjustment, which can be adjusted by stirring. Soaking modification refers to the method of water energy evaluation to adjust the modification. It mainly dissolves the modified material into liquid, and then immerses the steel slag prepared for modification in the modified material for 3-5 hours. In order to achieve the operational effect of material modification.

According to the actual demand, the operator can select the appropriate steel slag modification method. For example, the surface modification of steel slag is mainly to be used as one of the building materials, and the proportion of modified resources is large. In the subsequent modification adjustment, the two methods of stirring and soaking are mainly selected for modification operation. All the modified steel slag was immersed in the modified solution according to the standard of 1:2. After soaking for 5 hours, it was taken out and spread over the regional structure, and then the modified material was applied to the soaked steel slag material. After the steel slag material is soaked initially, the internal space density is well filled to realize the orderly filling of the internal structure, and the external stirring after the subsequent material filling is reinforced twice. This kind of resource treatment method has the effect of surface modification and reinforcement adjustment.

2.2 Amount of Surface Modified Material
Because the porosity space of steel slag itself is very much, in order to make the surface modification effect of steel slag best during the specific surface modification adjustment period, it should be based on the actual situation of surface treatment of steel slag, and the reasonable selection of the amount and specific gravity of surface modified materials should be carried out accordingly. For example, when the modified steel slag is used as the construction raw material in a certain project, the specific gravity of the steel slag is first measured and adjusted according to the standard of steel slag: modified material \(=3:5\), so as to ensure the complete filling of surface space during the specific production and application of the material.

In the course of the concrete implementation of the surface modification of steel slag, the orderly implementation of the modification work, in addition to the order regulation of the basic modification series activities, also needs to coordinate the adjustment of the specific gravity of the application of the modified material according to the actual situation of the steel slag modification.

3. Performance Analysis of Modified Steel Slag Asphalt Mixture
In order to study the application of modified steel slag in detail, this section is analyzed by experimental exploration [2].

3.1. Experimental Materials and Methods
3.1.1. Experimental Materials. For the performance analysis of modified steel slag asphalt mixture, the materials used mainly include modified steel slag material, asphalt raw material, limestone aggregate, mineral powder, and related raw materials used during experimental stirring.

3.1.2. Experimental Methods. The experimental analysis methods are summarized as follows: (1) asphalt, mineral powder and modified steel slag and aggregate are mixed in the experimental process. The mixed part of modified steel slag was 1 group, and the mixed group of limestone aggregate was 2 groups. (2) Two groups of experimental materials were placed in water erosive solution, and their militancy, aggregate effect and the change of the whole curve of mixed materials were observed and analyzed.

3.2. Experimental Results
The results of this experiment show that in the process of water-soluble resource fusion, the water temperature of the group of materials increases during the water-soluble experiment, which makes the load pole of the material itself change accordingly. The temperature changes from 40°C to 10°C in this experiment. The load pole varies between 40-900 KPa. At the same time, the number of cycles of load action is 200-10 cycles. The frequency of phase angle change during the practical application of the modified material will change with the change of temperature, and the change process will obviously increase first and then decrease. The aggregate frame part will also change with the dynamic model as a whole. In addition, the microstructure of the modified steel slag under water erosion in the experiment is shown as 1, and the internal structure is in sharp contrast with the original tissue density [3].

![Figure 1. Modified steel slag material](image1)

Two groups of materials in the process of water-soluble resources and resources fusion, water temperature during the water-soluble experiment, the material itself load pole position changes accordingly, the temperature change in this experiment is 30°C-15°C, at this time its load pole position changes between 40-800 KPa. At the same time, the number of cycles of load action is 200-100 cycles. The frequency of phase angle change during the practical application of the modified material will change with the change of temperature, and the temperature structure will almost show a flat development trend in the process of its change. The aggregate frame part is also always in a relatively stable state. In addition, under water erosion, the microstructure of the modified steel slag in the experiment is shown as 2, and the internal structure is relatively loose with the original tissue density.

![Figure 2. Structure chart of limestone](image2)

### 3.3. Discussion

**3.3.1. Characteristics of Expansion.** The modified steel slag was used as the main raw material. Because the internal space and surface area of the modified steel slag belong to the property improvement in the space range, the proportion of water filling in the steel slag is relatively low in the water erosion environment during the subsequent application. Therefore, under the condition of comprehensive analysis of water-soluble expansion environment, the expansion characteristics of the material itself remain relatively stable, which is due to the modification of steel slag itself. The expansion characteristics of the material itself have been optimized [4]. The limestone used in No.2 experimental material has high water absorption and high spatial density of its structure. When the external environment is converted from drying to water environment, it is possible to have high compatibility of the material itself during the treatment of water-soluble resources [5]. Therefore, the material itself is naturally worse than the application of group 1.

**3.3.2. Analysis of Aggregate Effect.** Comprehensive analysis of aggregate effect is also the main aspect of epoxy regulation of steel slag property to water soluble environment. In the process of water
solubility regulation of a group of materials, there is a tendency of temperature variation in water soluble materials. This is due to the relatively low heat value of the modified steel slag itself, which will produce heat during mixing with concrete. However, because the modified steel slag itself will not increase the heat of the mixture, with the gradual extension of the mixing time of the material, the temperature will decrease obviously, and the aggregate effect of the material after mixing is better. In the water-soluble environment of two groups of materials, limestone itself will produce huge heat in the state of water, and its process will increase the heat dissipation strength of aggregate materials. Therefore, it is easy to appear the problem of insufficient fusion of mixed materials in the application of material mixing. In contrast, the modified steel slag used in group 1 experiment has better material regulation.

### 3.3.3 Overall Change in Mixture

The overall change of the mixture itself can also have a certain impact on the aggregate effect of the material. In the first group of modified steel slags, the surface bond effect, filtration effect and load capacity of the mixture were obviously changed in the whole morphology of the modified steel slag. The limestone in the two groups produced calcium hydroxide after water, the hardness of this kind of substance was higher, but the possibility of local material deterioration of the mixture after mixing was also higher, which would interfere with its subsequent application. That is to say, in the process of studying the properties of modified steel slag asphalt mixture, we pay attention to the analysis of the overall change of the mixture during the research period of the mixture material, and evaluate the mixing effect and factor effect of the material [6-10].

Conclusion: to sum up, the surface modification technology of steel slag and the performance analysis of modified steel slag asphalt mixture are the theoretical induction of the optimal application of industrial production and processing resources. On this basis, the performance characteristics of modified steel slag asphalt mixture were studied by surface modification method selection, surface modified material dosage, expansion characteristics, aggregate effect analysis, and overall change of mixture. Therefore, the analysis results provide a new idea for the comprehensive application of modified steel slag asphalt mixture resources.

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