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Research on the Characteristics of Shale Three-axis Compression Sound Emission Features

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Abstract: In the shale gas development, the lack of stability caused by the transformation of the reserve layer is an important engineering problem to be solved. This article is based on the compression test and sound launch technology. The impact of rock destruction, crack type, and the process of sound launch features during compression. The results show that: The bell counting count of sound transmission is volatile and there is a gap. On the eve of the stress peak, the bell counting count rapidly increased to the maximum value; the energy is small in most of the time, the energy increases when the crack expansion, and the broken damage occurs in the rock -sample. At the same time, the energy released is the most.

1. Introduction

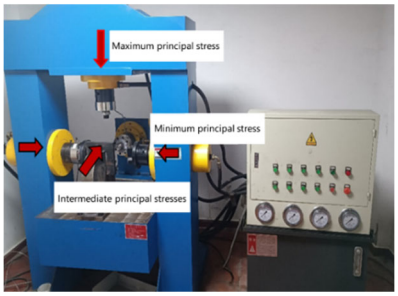
In the development of shale gas, due to the poor characteristics of the shale storage layer and low penetration rate, technical transformation reservoirs such as horizontal well drilling and hydraulic fracture[1] need to be adopted. A very prominent problem[2], so the research on the characteristics of shale crack expansion is of great significance[3]. Sound transmission technology is the acoustic method of studying rock damage. The strain stored in the process of rock can be released in the form of elastic waves. The sound transmitting signal released by rocks contains the rich information that reflects the internal defects of the rock. It can be inferred that the internal changes of the rock, the destruction process and its destruction mechanism of the backstone[4].

Scholars at home and abroad have carried out relevant experimental research on rock based on sound launch technology. Hou Zhenkun et al.[5] used sound transmission technology to conduct a single -axis compression test shale in a single -axis compression test shale in various heterosexuals such as the heterosexual and other shale of various layers; Single axis and three -axis compression experiments with 30 °, 60 °, and 90 ° rock -like samples indicate that there are large differences in different angles of samples; Chen Xueping et al.[7] carried out indoor single -axis compression to a variety of rocks through sound launch technology Test, study the evolution of the sound transmission signal during the destruction of rocks; Tan Ying et al.[8] 4 kinds of rocks of granite, widite, sandstone, and marble for Brazil to study the rupture mechanism of rocks in stretching state;

In summary, the current research on the shale is less and concentrated in the analysis of the heterosexual properties of the shale, and the research on the rules of damage and the evolution of damage in the process of tracking and positioning of sound launch tracking and positioning is less[9]. Therefore, in order to explore the damage damage of shale at different levels of rational angle, this article selects Longma Xixi display shale as the research object, conducts the sound transmission test of the hard and crispy shale, the characteristics of the rock destruction of rocks at different layers of rational angles, and the compression process of the compression process Analysis of sound emission feature parameters.

2. Test Device

The compressed equipment in the compression test system adopts a self -developed three -axis large -size core mechanical load experimental device; the sound launch equipment uses the full information sound transmitter of the Beijing Soft Island Times Company, equipped with 8 sound transmitting sensors and front placing largers, computer operations, computer operations Show the platform. The test system platform is shown in Fig 1.



(a)Compressed test system platform

(b) Sound transmission system

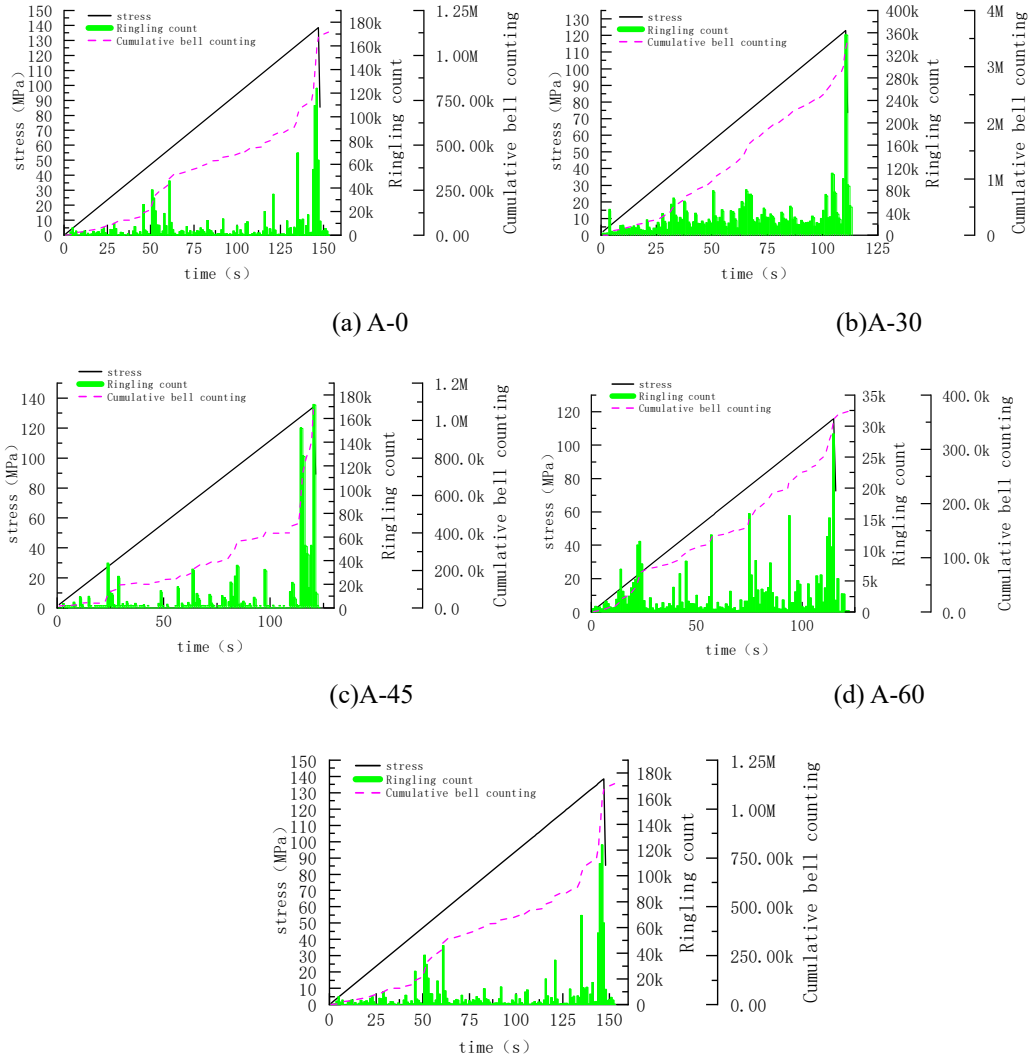
Figure 1. Schematic diagram of the compression system and AE device

3. Analysis of Sound Emission Feature Parameters

Different layers of raw radiography, ringing of bells, cumulative numbers and stress changes over time are shown in Fig 2. The timing changes of the sound launch process are divided into four stages: initial stage, severe stage, decline stage, and silence stage[11-13]. Due to the high shale brown,

continuous loading will cause the sample to crack and destroy, forming a number of crushed rocks, which is not conducive to the contrast between the sound launch positioning point and the actual rock -like destruction. By the stage of sound launch and the silence stage.

At the beginning of the initial stage of the sound launch, the cracks and elastic phase during the corresponding rock injury process. The early native cracks were closed and closed. As the stress continued to increase, the inside of the test parts deformed, resulting in new cracks, resulting in most of this stage. The volatility of count, but the value is small. At the severe stage, the new cracks generated inside the rocks continued to expand, the crack network gradually formed, the local cracks were staggered, and the main fracture surface gradually was formed. As shown in Fig 2 (a), (b), (c), (e), when the stress loading process generates a new crack, the sound launch activity changes small; Essence (d) The severe stage in the middle of the loading is due to the internal defects of rocks, which leads to a break and destruction in the early stage of loading.



(a) A-0 (b)A-30

(c)A-45 (d) A-60

(e)A-90

Figure 2. The relationship of acoustic emission ringing count, ringing cumulative count and stress with time

4. Conclusions

This study conducted a test -based compression and damage test based on the trial of different layers of rational shale. It studied the impact of layers on the destruction of rocks and the law of sound emission signal. The conclusion was summarized as follows:

During the shale compression process, the significant fluctuations of energy each time the energy fluctuates the cumulative breakthrough of the current platform, indicating that the crack expansion of the rock and the sound launch activity is fierce. The peak of stress and maximum energy release and the maximum moment of bell counting are corresponding, indicating that the peak signal peak and stress peak value of the sound transmission of the sound of the shale loading process is good.

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