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**AN EVALUATING AND DETECTING SYSTEM OF DIAMOND SAW  
BLADES CUTTING PERFORMANCE  
(МЕТОД ОЦЕНКИ СВОЙСТВА ВЫРЕЗАНИЯ ДИСКА С АЛМАЗНОЙ РЕЖУЩЕЙ  
КРОМКОЙ И ЕГО ИСПЫТАТЕЛЬНАЯ СИСТЕМА)**

*Рассмотрены методы оценки остроты, рабочего ресурса и других свойств дисковой пилы с алмазной режущей кромкой при обработке каменных материалов, а также разработана контрольно-измерительная система для этих параметров.*

**Preface**

Diamond circular saws are widely applied in cutting stone material, such as marble, granite, ceramics and concrete, and serve as a kind of main cutting tools in stone industry. Typical circular saws see fig. 1. It was reported that 70 percent of manmade diamond was used for producing saw, so how to improve saw's cutting efficiency, life and lower cost are a main studying direction at all time in saw industry.



*Fig. 1. Typical diamond circular saws*

**Evaluating method of cutting performance**

We can say that working condition of saw is very bad. Good quality saw should have many advantages, such as high cutting efficiency, long life, low noise and less stone waste. Because the physical and mechanics property of natural stones is distinctly different in element, particle size, structure and origin, ability cut easily or difficultly of stones is obviously different. On the other hand, under the same operation condition and stone, efficiency of cutting and life of wearing also is quite different. For example, some saws have very long life up to several hundred of square meter, but some not enough for dozens of m<sup>2</sup>. In a word, how to evaluate cutting performance of diamond saws is very significant. A kind of synthetically evaluation method was used in this paper by mixing with sharpness, cut areas, vibration and noise. Index of sharpness was characterized by cutting drag

force, feed velocity and working current. Index of life was deduced by changeable altitude of the cutting resistance and cutting current. The vibration and noise was judged as a secondary index of sharpness and longevity. Table 1 shows the method of analysis and evaluation.

Table 1. Relationship of parameters tested and index of evaluation

Parameters	Phenomenon analysis	Index of evaluation
Feed velocity	Rapid cutting velocity, small drag force account for sharpness	sharpness
Change of cutting force	A large increasing extent of cut force and change rapidly, show that life is not enough	life
Working current	Big working current, not enough sharpness	sharpness
Cut noise	Body deformation, strong noise, lack of sharpness and affect work life	indirection index
vibration	Strong vibration, grip and bring sparkle, broken flaws in stone edge, not enough in sharpness and life	Compensatory index

### Composing of testing system

Based on the above evaluation method, in September 2009, the authors developed a new detecting system of diamond blade cutting performance. The detecting system consists of three major components: diamond saw blade cutting unit, data acquisition unit, data analysis unit. Test cutting platform for stone positioning and cutting operations. Data acquisition systems collecting rotational speed (linear speed), rate of feeding, feeding power, motor power, cutting noise, vibration and many other parameters when the blade working. Data analysis system was designed for data analysis in order to evaluate the blade life, sharpness and other indicators.



Fig. 2. The picture of diamond circular saw testing system

### Diamond saw blade testing machine

Diamond saw cutting platform includes frame body and electronic control equipment. Cutting machine was made to install objects cut (such as marble, granite, ceramic, concrete tile etc.), including guided rail, main motor, vertical feeding system and horizontal feeding system, As shown in Figure 2. Main motor practice driving high-speed rotary blade, to cut the materials, feeding motor driving the horizontal feeding system to feed the material, lift motor driving lifting system to achieve cutting depth adjustment. Electronic control system control cutting machine, in order to realize the rate of feeding and rotational speed of variable speed to meet the different cutting linear speed rate of feeding. In test process, for different diamond saws, you can select certain

feeding rate to compare with standard data. For the same blade, you can choose different rotational speeds and feeding rate to study the cutting performance of saws or stones.

### Data acquisition system

Data acquisition system is composed of a variety of sensors, data capture card and related communications module. Sensors and its role are as follows:

- pressure sensors: measuring the feeding resistance of stone plate;
- current sensor: measuring the working current of the main motor;
- journey switch: measuring blade rotation speed (linear speed);
- rotary encoder: measuring the feeding speed of stone plate and the platform position;
- noise detector: measuring noise while saw blade working.

Acquisition system includes data acquisition card and two counters. Acquisition card of the largest six roads inspection can be connected to current, voltage or pulse signal. In this system, pressure sensor and the host working current (reflecting the cutting power) signal to connect to the inspection apparatus. Journey switches and rotary encoder connected to the counter, in order to detect the saw blade rotational speed, rate of feeding and platform position. Based on the command given, inspection acquisition card and counter communicate with the computer by VISA [1].

#### Data analysis and processing system

Data analysis and processing was complete with the computer. Software platform is base on Labview 8.6. The system was referred to standardized cutting data, by calculating and analyzing data collected, and comparing with the base data, then finally display the evaluation results of diamond saw blade.

#### Performance index of testing system

At present, the company of cooperation with us has produced this testing machine and applied successfully, thereby gaining obvious economical benefits. The following table 2 shows the performance of our testing system, naming TS-500° C type diamond circular saw testing machine.

Table 2. Performance parameters of testing system

Performance parameters			
Main motor power	13 kW	Saw rotation speed test and precise	0~2000 r/min±10
Main motor rotation speed	0~1500 r/min continuous djustable	Feed velocity test and precise	0~150 mm/s±0.2
Feed motor power	0.37 kW	Feed force test and precise	0~150 kg±1.5
Feed motor power rotation speed	0~1200 r/min continuous adjustable	Noise test and precise	0~130 dB±2
Saw tested size	Φ300~800 mm	Data sampling time	1ms-1.5s adjustment
Length of travel	By journey switch	weight	2t

Note: the system can test multi-parameters at real time, also relays and shows the former data

#### Conclusion

It is no deny that the research and test to Diamond circular saw are very important, including cutting stone efficiency, life and the ratio of performance and price and so on. Computer measuring technology and Labview software programming skills have been used successfully in this detecting system. These Parameters tested include the speed of saw rotation (representing linear velocity), feed-speed, feed force, motor power or current change, cutting noise and vibration etc. The system can measure and evaluate the saw cutting performance by comparing with the previous standard data. The special manufacturers can adjust the matrix material timely to meet consumers demand,

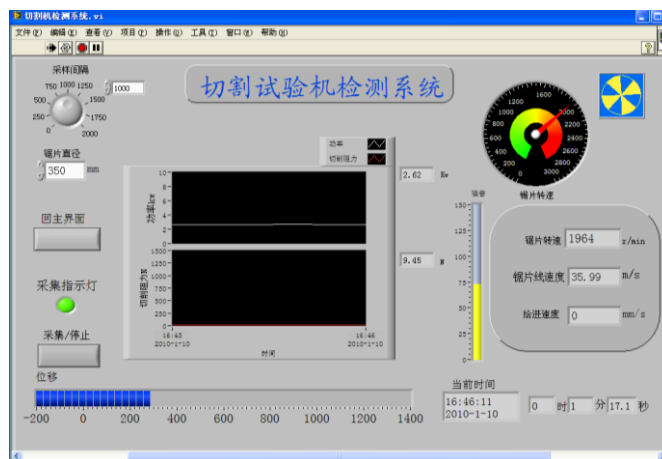


Fig. 3. Interface of data acquisition

and judge the quality of raw materials and sintering. Stone production plants can adjust properly technological parameters of equipment due to the cutting performance.

The detecting system has been applied successfully in practice, having excellent human-computer interaction, high test precise and convenient operation. The system can be widely used in stone production companies, saw production plants and the quality testing department etc. so market prospect is excellent.

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### О ВОЗМОЖНОСТЯХ ПОВЫШЕНИЯ ПРОДУКТИВНОСТИ НЕФТЯНЫХ СКВАЖИН

*Colmatage zone of a productive horizon oil well is one of main reason waste time and reducing productivity of drilling works. Methods have been description of slow down of colmatation processes.*

Как известно, что продуктивность нефтяных скважин неуклонно снижается в процессе их эксплуатации. Вскрытие продуктивного пласта сопровождается нарушением его естественных фильтрационных свойств в призабойных зонах скважин, что обуславливается перемещением частиц породы и проникновением в поровое пространство промывочной жидкости, ее фильтрата и шлама (представляющим суть кольматации) вызванным избыточным гидростатическим давлением, необходимым для предотвращения обрушения стенок скважины.

Кольматация является одной из основных причиной снижения производительности скважины с течением времени. На интенсивность ее проявления влияет множество факторов. В первую очередь это характер используемой промывочной жидкости.

Особенности позднего периода эксплуатации нефтяных месторождений обуславливают необходимость постоянного поддержания высокой эффективности и качества проводимых работ. Важнейшим критерием качества работ при бурении скважин, вскрытии пластов, вводе их в эксплуатацию и в процессе эксплуатации является минимизация негативного воздействия на природные коллекторские свойства продуктивных пластов.