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LETTER TO THE EDITOR

Analysis Method of Pollution Emission Characteristics of New Energy Vehicles based on ASM

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In order to measure the concentration of various exhaust gas components of vehicle engine exhaust, an analysis method of pollution emission characteristics of new energy vehicles based on ASM is proposed. The ASM working condition test equipment is composed of light chassis dynamometer, exhaust gas analyzer, electrical control system, computer control software, and auxiliary equipment (such as television), safety protection device, heat dissipation fan and so on. After the automobile is preheated to the prescribed hot state, it accelerates to the specified speed. According to the acceleration load of the specified speed of the automobile, the concentration of various exhaust gas components emitted by the automobile engine is measured by keeping the automobile running at the same speed under the loading of the automobile. The relationship between the discharge qualification rate and the emission and the working condition is analyzed by building the automobile emission model. The results show that the failure rate of the vehicle's NOx emission is up to 36% over 10 years, and the influence of the test conditions on the emission is small during the test.

ASM; New energy vehicle; pollution discharge

1 Introduction

ASM (Acceleration Simulation Mode) is also called steady-state loading acceleration simulation method, which refers to the acceleration of the vehicle to a predetermined speed after preheating to a predetermined state, and the acceleration load according to the predetermined speed of the vehicle. By loading the vehicle to keep the vehicle running at constant speed, the concentration of all kinds of exhaust gas components emitted by the vehicle engine was measured (Dai and Miao 2017).

Yu-Xiao Liu, Yi Wang published an article in 2019 in the journal Ekoloji, Issue 107, entitled "Real-time Monitoring System for Pollution Intensity of Carbon Emission in Ecological Environment." In order to monitor the pollution intensity of carbon emission in ecological environment in real time, the specific influence of each region on the change of carbon emission intensity was analyzed. A time monitoring system for carbon emission intensity based on ZigBeed is proposed (Liu and Wang 2019). The system takes CC2530 as the core, and the hardware design consists of two parts: location node and routing design. The PC terminal software part is composed of four modules, a communication module, a real-time data display module, a data storage module and a communication interface module. The election module. The test results show that the system has high monitoring efficiency and precision and has certain application value. On this basis, combined with ASM, the

emission characteristics of new energy vehicles were analyzed.

The simple working condition test method is one of the effective methods developed by the United States in the mid-1980's and developed by different load test methods. In the detection, the emission of the vehicle in the road is simulated under different conditions by selecting different loading power. In order to effectively control environmental pollution, countries have formulated mandatory emission regulations and emission standards to control automobile pollutant emissions (Mi et al. 2015). At present, the detection technology of in-use vehicle emissions in the United States and Europe represents the advanced level in the world, and many countries and regions refer to their automobile emission standard to varying degrees (Fu et al. 2017). The current emission evaluation of heavy vehicles is to adopt a certain driving condition and evaluate the emission level of the engine through the bench test, but it is very inappropriate to evaluate the emission level of the hybrid electric vehicle according to the engine. Heavy hybrid electric vehicle is equipped with a set of power auxiliary device on the basis of conventional engine. This device is designed to adopt targeted control strategy according to the actual driving conditions of the vehicle. To achieve the purpose of energy saving and emission reduction of vehicles (Fugiel et al. 2017). The actual operating condition distribution of such an engine is very different from that of the laboratory, and only the emission level of the hybrid vehicle is evaluated according to the engine emission and the energy consumption level.

In this paper, through a large number of experiments to test the ASM emission characteristics of light gasoline vehicles in use, the unqualified rate of vehicle emissions and the influence of test conditions on emissions are studied, and the NOx emission law of in-use gasoline vehicles is studied. It is of great significance to provide scientific basis for controlling NOx.

2 Idea description

2.1 ASM system composition

ASM working condition test equipment is composed of light chassis dynamometer, exhaust gas analyzer, electrical control system, computer control software, and auxiliary equipment (such as television), safety protection device, heat dissipation fan and so on (Yu et al. 2018).

2.2 Principle and method of ASM Test

ASM is also called steady-state loading acceleration simulation method of automobile. This method refers to the acceleration to the specified speed after the vehicle is preheated to the specified hot state. According to the acceleration load at the specified speed of the vehicle, the vehicle is kept running at the same speed by loading the vehicle. Determine the concentration of various exhaust gases emitted by automobile engines. According to the national standard, the ASM working condition in our country is divided into ASM5025 working condition and ASM2540 working condition. Under the condition of ASM5025, the simulated speed is constant at 25 km/h, and all kinds of exhaust gases are tested at 50% throttle opening. If the emission of the vehicle fails to meet the standard at this speed, the speed will be increased to 40km / h. Under the load of 25% throttle opening, the test is carried out and then the two test results are combined to determine whether the vehicle emission is up to standard (Zhang et al. 2017).

The specific test conditions are as follows:

1. ASM5025 working condition

After preheating, the vehicle accelerates to 25.0 km/h, and the dynamometer loads the vehicle as the set power when the vehicle speed is 25.0 km/h and the acceleration is 50% of the output power of 1.475 m/s^2. The vehicle continued to run for 10s at a speed of 25.0 km/h ± 1.5 km/h, t he working condition timer starts the timing (t=

0s), and the continuous operation 90 s (t=90 s) is the ASM5025 condition.

2. ASM2540 working condition

After the test of ASM 5025, the vehicle accelerates to 40.0 km/h immediately, and the dynamometer loads the vehicle as the set power when the speed of the vehicle is 40.0 km/h and the acceleration is 25% of the output power of 1.475 m/s^2. The vehicle runs continuously at the speed of 40 km/h ± 1.5 km/h for 10 s, the working condition timer starts to time (t=0s), and the continuous operation for 90 s (t=90 s) is the ASM2540 condition.

The driving wheel of the inspected vehicle is parked on the dynamometer drum, and the exhaust pipe is inserted into the sampling probe. When the vehicle starts, the tester controls the speed of the vehicle to the predetermined working condition speed (25 km/h and 40 km/J), and ensures that the vehicle can run stably with load through the electrical control system. The exhaust gas analyzer measures the content of different gas components in the exhaust gas of the vehicle under inspection, calculates the dilution coefficient through analysis, then calculates the modified CO, HC, NO exhaust emission concentration value, and gives the conclusive evaluation.

2.3 Vehicle Emission Model

The power source of electric vehicle is different from that of gasoline engine, so the emission characteristics are different. For gasoline engine, the fuel consumption volume (L) is V (Zhu et al. 2017).

$$V = \sum_{n=i}^{m} \frac{M_g}{i} \tag{1}$$

In the formula, M_g indicates the quality of the discharged pollutants (kg).

The vehicle emission test is far from large and complicated, but the characteristics of the system are analyzed in detail, and the requirements of working condition control in the test process are analyzed in detail. The system is very complex in nature, and its main performance is as follows:

(1) The test object of the system is all kinds of light vehicles in use, which are irregular, complicated and uneven in technical condition, which are restricted by the characteristics of engine performance and the uncertain factors of the technical condition of automobile transmission system. And the test auxiliary time is short, the test speed is fast, the man-machine compound control method can be adopted, and the system is coupled.

(2) In order to reduce the cost of equipment investment and use, ASM and VMAS195 vehicle emission test system, the loading device adopts cold Eddy current dynamometer. Compared with the hydraulic dynamometer, the air-cooled vortex current dynamometer has the advantages of good controllability, but as the result of formula (3) analysis, this kind of dynamometer has strong nonlinear absorption torque, excitation current and rotating speed. The parameters are time-varying and it is difficult to establish an accurate model, which is not conducive to dynamic control of (Gao et al. 2017).

3 Results

In a city, about 2 million vehicles are used, the number of valid samples for this analysis is 99,851, and the distribution of the sample vehicles is in the vehicle for the period 2010-2018. The selected A brand and B brand cars are Japanese cars and German cars respectively, and both cars have a large sample number and a wide age distribution.

3.1 Analysis of qualified rate of emissions

Through sample analysis, at present, the number of cars passed by ASM method is about 81% of the sample cars, and the unqualified cars account for about 19%. And the emission of the vehicle cannot pass the most important

pollutant to the NOx, and the NOx emission is up to 13.9%. The failure rate of three harmful pollutants is shown in Figure 1. Through figure 1, we can see that the unqualified rate of NOx is about twice as high as that of CO. The higher NOx emission concentration may be due to the short national use time of ASM method, and the control of HC and CO has been more mature.

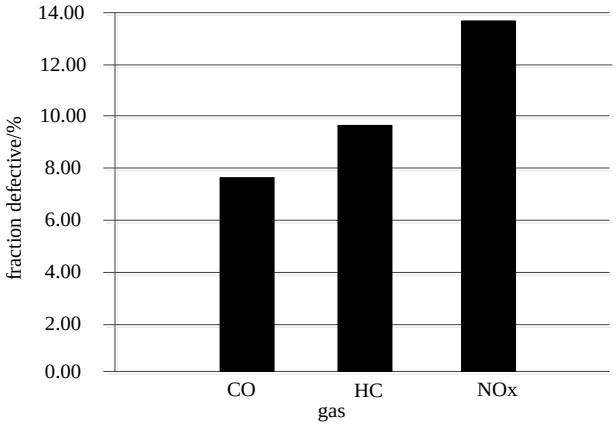

Figure 1 Unqualified rate of various gases

However, among all NOx unqualified vehicles, the rate of unqualified vehicles over 10 years is about 4 times of that within 6 years, as shown in figure 2. Therefore, the old vehicle should be the key spot check and test object.

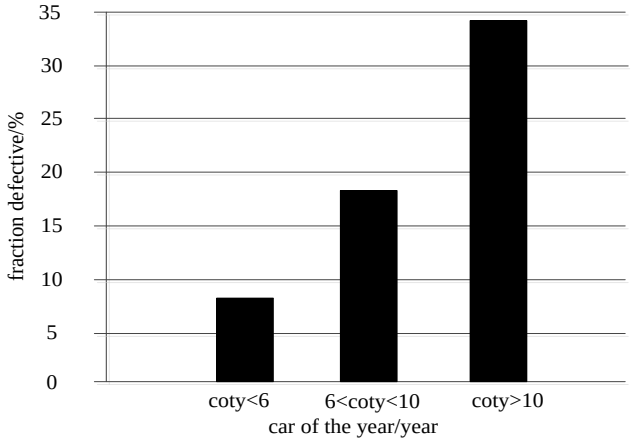

Figure 2 failure rate of vehicles of different ages

3.2 relationship between emissions and working conditions

ASM testing is divided into 5025 and 2540. Fig. 3 is a trend diagram of vehicle NOx emissions tested under both working conditions. It can be seen from the diagram that the two curves basically coincide with each other, NOx under 5025 working conditions. The emission value of NOx is slightly higher than that of 2540 working condition, which indicates that the working condition has little influence on the vehicle.

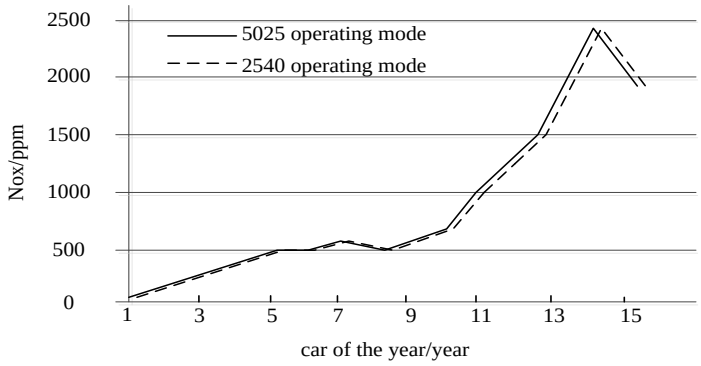

Figure 3 comparison of NOx emissions between 5025 and 2540 working conditions

4 Discussion

(1) The situation of vehicle pollution in a city in 12 years is more serious, the unqualified rate of vehicle is 19%, and the unqualified rate of $NO_x$is obviously higher than that of HC and CO. And more than 10 years of cars are the most serious, more than twice the number of cars under 6 years.

(2) The effect of the working condition on the vehicle is small when the ASM is detected, but the emission of the NOx at the condition of 2540 is slightly lower than that of the NOx when the working condition is 5025.

5 Conclusion

Environmental protection is one of the most important problems in the current automobile development, and the implementation of ASM is beneficial to reducing the pollution of the automobile to the atmosphere, in particular to the strict monitoring of the NOx emission. The test results of nearly 100,000 vehicles are studied. The results show that the failure rate of the NOx in the gasoline vehicle is higher than that of the HCO, especially over 10 years, and the failure rate of the vehicle's NOx emission is up to 36%, and the influence of the test conditions on the emission during the test is small.

Acknowledgement

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