THE REDUCTION OF POLLUTING PRODUCES FROM THE EVACUATION GASES OF TERMIC ENGINES

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SUMMARY

The evacuation gases analyst is made with the purpose to evaluate the perfection degree of the fuel burn to appreciate the heat loses because the incomplete burn, and because of the eventual escapes through the tightness to establish the air excess coefficient, fill up coefficient, to establish the pollution degree of the atmosphere with toxics produces.

How we well known, the evaluation gases of the Otto’s engine or diesel engines contain for the main pollution factors, carbon oxide, azoth oxides, sulfa and smoke produces.

Polluting degree depend on the engine type, on the functioning regime and on the fuel. Otto’s engine emits big quantities of carbon oxide, during the diesel engine emits in certain functioning regimes, more azoth oxides and a lot of smoke.

The phenomenon that the measuring apparatus is basing on are: the outspreads energy absorption in the infrared radiation spectrum, flame ionization etc.

All the determinations are executing for the purpose to find methods for reduction of polluting degree of environment.

APPARATUS AND METHOD

The evacuation gases analysis does with the purpose of the fuel burn perfection degree evaluation, to appreciate the heat losses because the incomplete burn and because the eventually escapes through the tightness, to establish the air excess coefficient, the fill up coefficient and to establish the pollution degree for the atmosphere with toxic produces, (Mărdărescu R., 1968).

In case of burning the fuel in engines, because of the high temperature the reaction stops before the integral consuming of the initial substances. This state in that the concentrations of the initial substance and of the final substances remained unchangeable in time, is named change state. In function of the temperature from the interior of the engine cylinder the equilibrium state is influenced of the pressure and of a inert gases presence.

Because of the dissociate at high temperatures the temperature of 1700 °K the burned gases will have: non dissociated components (CO₂, H₂O, H₂, at who in case of the air excess λ>1 is add O₂ and in case if the air is insufficient λ<1, CO₂ and H₂0) and components resulted to the dissociation:

- the dissociation of the dioxide of carbon 2CO₂ ↔ 2CO + O₂ and then

  2H₂O ↔ 2H₂ + O₂
Except these reactions in burn interval and the pressure grow a important role has the formation of the water hydroxyl, the dissociation of the hydrogen and oxygen molecules, the azoth oxide and the water gas reaction:

The water hydroxide forming reaction is produce by the scheme:

$$2\text{H}_2\text{O} + \text{O}_2 \leftrightarrow 4\text{OH}$$

The dissociation of the H\textsubscript{2} and of the O\textsubscript{2} goes to the atomic state:

$$\text{H}_2 \leftrightarrow 2\text{H}$$
$$\text{O}_2 \leftrightarrow 2\text{O}$$

The azoth oxide forms by the scheme:

$$2\text{NO} \leftrightarrow \text{N}_2 + \text{O}_2$$

The available hydrogen with the carbon hydroxide goes to the water gas reaction:

$$\text{H}_2\text{O} + \text{CO}_2 \leftrightarrow \text{N}_2 + \text{O}_2$$

These reactions don’t have the same importance, being in the same time influence by the composition of the fuel mixture.

In this way, the dissociation of the carbon dioxide has a big importance for the rich mixtures $\lambda<1$ and in the reduced mixtures prevail the forming of the azoth hydroxide and azoth dioxide.

The variation of the burn produces composition in function of the temperature is showed in fig.1:

![Figure 1](image)

The composition variation of the burning produces from the evacuation gases in function the temperature

It notices that after a temperature of engine functioning all the evacuation gases have a fast growing. This solicit the maintaining of the engine functioning temperature that smaller them T\textsubscript{d}.

In the quantity of the compounds dissociated, the quantity of the integral burn produces ( CO\textsubscript{2}, H\textsubscript{2}O ) is being reduced in change is being form a lot of dissociation produces ( CO, H\textsubscript{2}, OH, NO , O , H ).Before the dissociation temperature T\textsubscript{d} the moll number is variable. For T>T\textsubscript{d} the moll number grows because the equilibrium reaction have place with a grown of the moll number, except the forming reaction of the monoxide of azoth.
Afterwards it will make specifications about the pollution degree of the atmosphere with toxic produces and with the toxic produces reduction methods, problem that represent a important job in the general effort of the modern engine perfection for the automobile.

How we all know, the evacuation gases of the intern burn engines contain polluting produces: carbon oxide, azoth oxide, hydrocarbons; oxidants produces: Plumb and other compounds of the Plumb; compounds with S and smoke, (Stratulat M., 1980).

The polluting degree depends of the engine tip, of the functioning regime and of the used fuel and of the ratio between the air quantities and of the fuel present in the air-fuel mixture.

The CO, CO₂ concentration variation in the evacuation gases in function of the air-fuel ratio (d).

The growing of the air quantity in fuel mixture the value \( \lambda = 1,1 \) poor mixture leads to the descending of the CO percent to the spark engine and to the growing of the CO₂ percent at Diesel engines to a value when the percent start descending.

The Otto engine emits big quantities of carbon oxide, and the Diesel engine emits in certain compressing regimes more azoth oxides and smoke.

For creating a complete image of the toxics substances from the evacuation gases of the engine, in this way that it can understand the regulations precautions and the methodology of the determination of the oxides is showed the table nr.1 obtained in the following attempt conditions:

- With the gases analyst for CO and \( \lambda \) at the reduced revolution of rolling without load and in accelerated regime at normal thermal of functioning;
- The oil from the engine temperature > 60°C
- The temperature of the ambient environment between 5 - 30°C;
- The atmospherically pressure 80 – 1025 mbar;

The analysis of the evacuation gases at the engine with lighting through compress is made with a apparatus that measuring the opacity through free acceleration between the revolution without load and the maxim revolution without load at normal terminal regime.

Pollution degree is depending of the automotives traffic that passed by a point in a time unit, also with the engines functioning regime. That’s why, all the regalements viewing the limitation of the evacuation toxic gases are made reference to the engines and automotives functioning, (Abătâncei D., 1980).
For the engines constructor the tests on the work-stand are interesting because they can appreciate the influence of the different constructive elements of the engine about polluting emissions gases.

The methodology and the apparatus for testing are the same like in the case of measuring on the automotive but the distinguisher is the collecting mode of the gases sample.

Different methods are known for the polluting produces determination. A used application has the methods that are based on the phenomenon that permit a rapid and proportionally answer with polluting concentration, methods that lead to a standard apparatus.

The phenomenon that is based the measuring apparatus are: the absorption of the outspread radiation energy in the infrared radiation spectrum, the flame ionization, the chemical light, the light observation in the visible spectrum.

Figure.3

Apparatus utility:
Analyst with infrared razes

Figure.4

Analyst with ionization
For determination it was using different apparatus - the gases analyst and the lambda derrick for Otto’s engine and the apparatus that measuring the opacity for Diesel.

REDUCTION METHODS OF THE TOXIC PRODUCES FROM THE EVACUATION GASES

The modification of the compressing ratio and of the air-fuel ratio

The hydrocarbon and azoth oxides compounding variation in the evacuation gases in function of the compressing ration (a) and of the air-fuel mixture (b).

The growing of the compressing ratio influences negative over the components of the evacuation gases (figure 6a). The air quantity growing from the fuel mixture leads to the descending on the nitrogen oxide values (figure 6b).
The use in the engine construction of the supplementary burn rooms that work with rich mixture there where is the spark plug, (Sărăcin I., 2000). This kind of engine work with reduce fuel consumption with insignificant emissions of CO, NO but at reduces loads and without loads result a grow of the concentration of hydrocarbon in evacuation gases.

CONCLUSIONS

- In the evacuation gases of the engine with intern burn are present big quantities of hydrocarbons, carbon oxide and azoth oxides;
- The toxic produces presence show the abnormal functioning of the engine and have ecological indications;
- The polluting emissions reduction it’s done thought the modification of the constructive and functional parameters respective: the burn room form, the compressing ratio, the air-fuel mixture quality
- The fuel quality has influence on the quantity of polluting emissions;

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