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ANALYSIS OF GASES FROM BTEX GROUP BY FOURIER INFRARED SPECTROSCOPY (FTIR)

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1. Introduction

Organic chemicals are up to 96% of all emissions of hazardous compounds from a typical iron foundry. May be released during operations related to the exercise of casting, starting from the preparation of the mold sand, molds and cores, pouring liquid metal, cooling until after knocking. These compounds are also released during curing and storage of the cores, when using organic binders. The main source of harmful gases are binders for molding sand containing organic resins and hardeners, as well as extras such as lustrous carbon carriers used in green sands [1]. As a result of the impact of the high temperature of the molten metal, they are decomposed and form new compounds [2-6].

The determinant of the dangers of molding to the environment is the emission of compounds from BTEX group (benzene, toluene, ethylbenzene and xylenes) and PAHs (polycyclic aromatic hydrocarbons [7-9].

At the Faculty of Foundry Engineering AGH for many years conducted research related to evaluation of the harmfulness of molding. Methodology has been developed and test stand gases using FTIR. It allows qualitative and quantitative analysis of gas nearly 400 chemical compounds, both organic and inorganic.

In this article we have presented preliminary results for the calibration gas containing in its composition BTEX compounds.

2. Experimental

The quantitative analysis of standard gas samples were carried out according to their own methodology developed at the Faculty of Foundry Engineering University of Science and Technology. The proposed research methodology does not need to download a special gas adsorbents. The sample is introduced into the cell in gas phase.

For quantitative analysis program was used Qasoft 5. It provides a thorough quantitative analysis of the recorded spectrum for nearly 400 chemical compounds (organic and inorganic) without determining the calibration curve for each test gas component.

Figure 1 shows a schematic representation of the recording and analysis of infrared absorption spectra.

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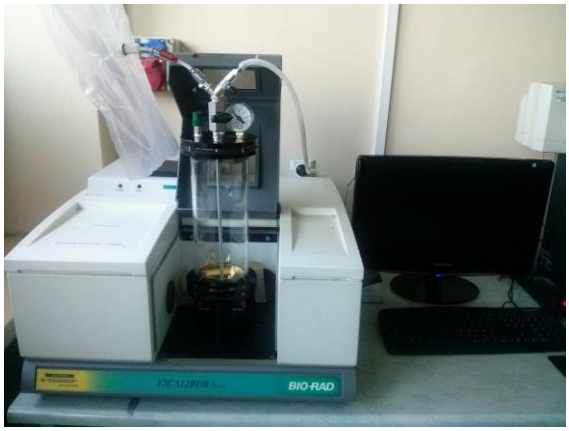

Fig. 1. The view of the position of the test gases by FTIR

3. Results and discussion

Table 1 show the results of calibration gas using FTIR. They were matched with data declared by manufacturer.

Table 1. Comparison of the results of the calibration gas analysis by FTIR method with results declared by producer [ppm]

	Benzene	**Toluene**	**Ethylbenzene**	**o-xylene**	**m-xylene**	**p-xylene**
Results of producer	394	352	61,7	97,0	91,8	87,3
Results by FTIR	432	154	511	127	88	98

As the table shows results of reference blend made from FTIR spectrum does not coincide with results of analysis performed, and declared by supplier of reference blend. The biggest differences in results relate to toluene and ethylbenzene. Based on a thorough analysis of recorded spectrum can be concluded, that main reason for these discrepancies is presence of deformation bands of CO_2. Band occurs in-band analysis of compounds from the group of BTEX.

4. Conclusions

- Analysis of gases from BTEX group by FTIR can be performed with high accuracy, provided elimination of carbon dioxide by IR. This effect can be achieved by appropriate modification of bench.
- The presence of CO_2 in atmosphere makes the deformation vibration frequency of this compound coincides with wave count range, in which there are bands analytical BTEX compounds causing falsify results of quantitative analysis.
- A prerequisite for quantitative analysis is to obtain a high-quality FTIR spectra for gas sample.

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