

**ДЕРЖАВНА СЛУЖБА УКРАЇНИ З НАДЗВИЧАЙНИХ СИТУАЦІЙ  
НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ ЦИВІЛЬНОГО ЗАХИСТУ УКРАЇНИ**

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# **МАТЕРІАЛИ**

**міжнародної науково-практичної конференції  
молодих учених**

**«Проблеми та перспективи  
забезпечення цивільного захисту»**

**Харків – 2022**

## DEVELOPMENT OF ATMOSPHERIC COMPOSITION CONTROL METHODS USING FOURIER SPECTROMETERS

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An analysis of methods for the remote determination of substances in the atmosphere established that the leading position is occupied by optical methods for monitoring the composition of the atmosphere, which include recording and subsequent analysis of electromagnetic radiation from the object of study [1]. To control the composition of the atmosphere in emergency situations, the most rational use of the Fourier transform spectrometric complex (FSF).

To solve the problems of remote sensing of the atmosphere, a number of manufacturers have developed mobile Fourier spectrometers [1]. Most of them are equipped with a single-element photodetector and a manual guidance system on the object of study. Among such models, it should be noted the products of Midac ([www.midac.com](http://www.midac.com)) and EDO corporation ([www.nycedo.com](http://www.nycedo.com)), the spectral resolution of which reaches  $0.15 \text{ cm}^{-1}$  in the working range of 7–40  $\mu\text{m}$ , the minimum detectable concentrations at the presence of an external IR illumination source of 0.1–15 ppb. The second generation of mobile Fourier spectroradiometers include the similar products MR100 and MR200 from Bomem ([www.bomem.com](http://www.bomem.com)) and K300 from Kayser ([www.kayser.it](http://www.kayser.it)). Models of the MR series provide a spectral resolution of  $0.2 \text{ cm}^{-1}$ , a scanning speed of 2–100 spectra in the spectral range of 2 to 15 microns. Recommended measurement path lengths for active methods are 5–500 m. Currently, more technically advanced models of Fourier spectroradiometers, initially oriented to passive operation, have also appeared. These are the developments of the companies “Bomem” (model CATSI), “Bruker” (model OPAG22), “Blocking Engineering” (models Model 100, Model 500 and Block I-Spec). Models MCAD and PORTHOS are fully automated systems and are designed to operate in the range of 7–14 microns in order to identify toxic substances and industrial ecotoxins in the atmosphere with a range of 0.1–5 km.

In the Russian Federation, Fourier spectrometers are developed specifically for systems for passive detection of substances in an open atmosphere in an automatic mode. In cooperation with a Bauman Moscow State Technical University has developed and created a series of mobile Fourier spectroradiometers with a spectral resolution of  $4\text{--}8 \text{ cm}^{-1}$  in the working range of 8–12  $\mu\text{m}$ , an interferogram scan time of 0.3 s, and a detection range of up to 6 km and the probability of detecting substances is more than 0.9. IR Fourier spectrometers of type IKFS-2 developed by the Vavilov Institute of Optics, the Keldysh Research Center and the Space Research Institute of the Russian Academy of Sciences for solving problems of monitoring the Earth’s atmosphere from orbiting satellites.

### REFERENCES

1. Scanning Fourier transform spectrometer in the visible range based on birefringent wedges. Aurelio Oriana, Julien Réhault, Fabrizio Preda, Dario Polli, and Giulio Cerullo. *Journal of the Optical Society of America*. 2016. Vol. 33. Issue 7. 1415–1420.