

# Microfabricated GC for Analysis of CO and CO<sub>2</sub> in Exhaled Air

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## ANNOTATION

The paper presents the application of Microfabricated GC (size - 220×145×55 mm; weight -0.75 kg; power consumption less than 10 watts) to assess carbon dioxide and carbon monoxide in exhaled air . The time of one analysis cycle was 40 sec. The standard deviation for the analyzed compounds did not exceed 0.5%. The detection limit was 150 ppb for carbon monoxide and 50 ppm for carbon dioxide. The presented device showed the promise of its use in the analysis of biomarkers in exhaled air.

## Introduction

Assessment of the body's energy costs and control of its functional state are necessary for the competent construction of the training process of professional athletes. This problem acquires particular relevance in the aspect of assessing the functional capabilities of the body of athletes in the process of adaptation to specific muscular activity, when sports training should be aimed at increasing functional reserves, their readiness for mobilization and increasing efficiency [1-3].

## Experimental

The experiment was carried out on a micro GC with micro-filler column filled with Carboxen adsorbent (carrier gas - helium). Micro-TCD based on sensors manufactured by CCB MIET (Figure 1). The absolute calibration method was used to construct the calibration dependence. The construction of the calibration dependence was carried out using calibration mixtures containing 10 ppm carbon monoxide and 3% vol. carbon dioxide. RMS from the calibration dependence did not exceed 0.5% of the measured value.

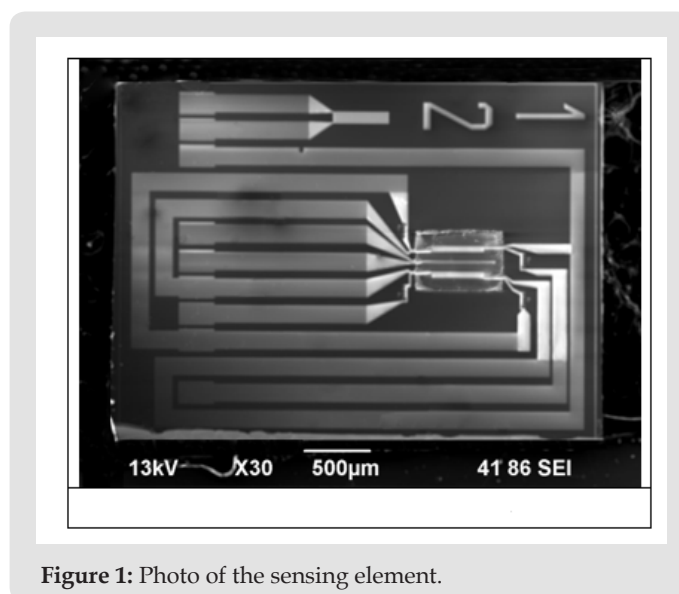


Figure 1: Photo of the sensing element.

## Result

The presented equipment was used for the analysis of carbon monoxide and methane in exhaled air before and after physical activity of the respondent. The results of the study are presented in Table 1. As can be seen from the results presented in Table 1, the content of carbon monoxide after 15 minutes of physical activity increases 2.5 times from 3.6 to 9 ppm, and carbon dioxide doubles from 3.9% to 7.9%. The presented micro GC, due to its low weight-dimensional characteristics and cost, seems promising for use in assessing the training process of professional athletes and analyzing biomarkers in exhaled air.

**Table 1:** Values of retention time, height and area of the peak.

No	before physical activity		after physical activity	
	CO, ppm	CO <sub>2</sub> , %	CO, ppm	CO <sub>2</sub> , %
1	3,2	3,8	9,3	7,9
2	4,1	3,7	9,4	7,8

3	2,7	4,0	11,2	8,0
4	3,9	4,0	8,8	8,0
5	3,3	3,9	8,6	8,1
6	4,1	4,0	7,8	7,8
7	3,4	3,7	6,6	7,9
8	3,5	3,8	9,5	7,6
9	3,9	3,9	6,4	8,0
10	3,7	3,9	12,9	8,1
Среднее	3,6	3,9	9,0	7,9

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