2.15. "ELECTRONIC NOSE" MULTISENSOR SYSTEM FOR EXPLOSIVE MATERIALS DETECTION

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Introduction. The report corresponds to section II “Antiterrorist diagnostics”. At present the real danger of terrorist attacks with use of explosion materials is sharply increased all over the world. One of the most effective counterterrorist operations is to provide the pro-force with the up-to-date equipment.

The perspective direction of the improvement of physical protection systems (PPS) is to use the innovation achievements in nanotechnology, nanomaterials and nanosystems. There is a basis the development of devices using new technologies, including nanotechnology. New technologies will greatly allow for improvement of PPS performance characteristic. For instance, nano-sensors are capable to find the presence of even a single molecule of explosion, poisoning or biologically compounds midair.

In the range of the works announced about the development of semiconductor sensor both on the base of several metal oxides [1 – 5], and the most wide-spread in this case is the tin dioxide cause of it good electro-physical parameters and ease manufacturing, and sensors on the base of thin polymeric composite films [6 – 8]. However the real sensitivity of these instruments does not exceed 5,000 ppm even at determination of high volatile material.

Results and discussions. At present the development of “electronic nose” a compact device detecting explosion materials in extrafine amount is the result of research and investigations performed by that FSUE “SNPO"Eleron”, Rosatom has been involved since 2005. This device is a multisensor system for selective detection of components of gas mixtures.

The increasing of sensitivity of multisensor system is also necessary for the reason of detection of extremely small concentration of wide range explosives and other potential dangerous materials.

Electronic nose is based on arrays of resistive sensors to provide efficient, real-time classification of dangerous compounds. These systems have been developed using R. Axel and L.B. Buck mechanism of the olfactory recognition of explosive materials. The circuit is designed to drive a resistive load with a constant current. The conductivity of each sensor is changing when contact with the detecting compound.

The new type of chemical sensors are composition ones, including nanoparticles of metals, metal oxidizes and polymers. Such sensors operate at normal room conditions (internal temperature) and show high sensitivity and selectivity, quick and reversible absorption.

The unique chemical image of each compound is formed to account signal set from different sensors.

The recognition of materials is based on “education” of electronic nose. The education of the unit is formed by record response from resistive sensors array when a gas containing individual material flows through. All sensor responses from different vapours of corresponding materials are saved as the system data base. Therefore, the recognition is realized by comparison of the response from analyzed one with the response from the individual material, available in databank. Electronic nose reports about presence of determined material or several materials in analyzed gas in case of close coincidence of the response or combination of several responses.

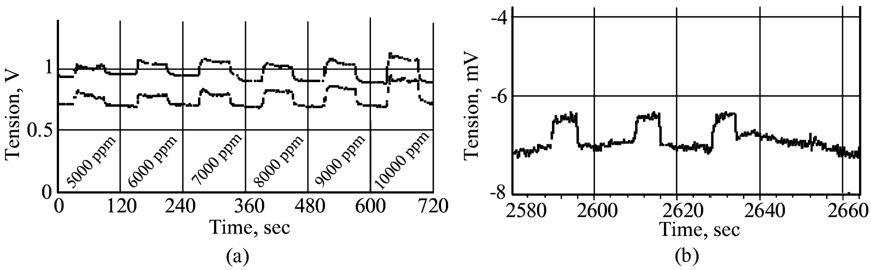

Fig. 1. A typical raw data response:
using array of conducting polymer composite sensors to propanol in the concentration range 5,000 – 10,000 ppm [7] (a), using a semiconducting tin oxide sensor to thrinitrotholuol in concentration is about 1 ppm (b)

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