

Halyna KLYM, Yuriy KOSTIV

Lviv Polytechnic National University

Development of multifunctional sensor system for environmental and medical applications

Abstract. The multifunctional sensor system is developed by using nanostructured multilayer thick-film structures based on spinel-type NiMn_2O_4 - CuMn_2O_4 - MnCo_2O_4 manganites and magnesium aluminate MgAl_2O_4 . The technological features of nanostructured sensor preparation are represented. The diagram of this system is proposed. This system with microprocessor signal processing is shown to be successfully applied for integrated temperature/humidity environment monitoring and medical applications.

Streszczenie. Wielofunkcyjny system czujnika opracowany przy użyciu strukturach nanostrukturalnych wielowarstwowych grubowarstwowe oparte na spinel typu NiMn_2O_4 - CuMn_2O_4 - MnCo_2O_4 i MgAl_2O_4 i MgAl_2O_4 . Właściwości technologiczne przygotowania nanostrukturalnych czujników są reprezentowane. Schemat tego systemu jest proponowane. Ten system przetwarzania sygnału z mikroprocesora wykazano, że z powodzeniem stosowane w czujnik temperatury/wilgotności i monitorowania środowiska i medyczne.

Keywords: sensor system, environment, bio-medical application, thick-film structure.

Słowa kluczowe: system czujników, środowiska naturalnego, bio-medycznym, struktura grubowarstwowe

Introduction

Nowadays, the environment and bio-medical sensing electronics is an integral attribute of the modern human society. The sphere of sensor applications expands hourly. Even in the fields where society managed with natural perception of external influences yesterday. The sphere of sensor application stretched from year to year, its including such important sectors as consumer, automotive, medical electronics (clinical fever thermometers, esophageal tubes, infant incubators, internal body temperature monitors, internal temperature sensors, myocardial probes, respiration rate measurement equipment, skin temperature monitors, thermodilution catheter probes, etc.), industrial electronics, communication, instrumentation and computer.

Especially place in this row belongs to temperature and humidity sensors, since monitoring and controlling of these environmental parameters is very important economical task, resolving of which cannot be overemphasized. They are practically indispensable in medicine (for example, in the systems of breathing control, thermostats, operating rooms and pharmaceuticals), systems of vital functions protection in mineral resource industry, etc.

The aim of this work is development of multifunctional microprocessor system by using nanostructured temperature/humidity sensitive thick-film sensors for environment and medical applications [1].

Development of sensor system

Temperature- and humidity-sensitive pastes for obtaining of sensor elements were prepared by mixing powders of basic nanostructured ceramics with ecological glass powder, Bi_2O_3 and an organic vehicle. The prepared pastes were printed on alumina substrates with Ag electrodes using a manual screen-printing device. Then thick films were fired in furnace PEO-601-084 at 850°C [2].

The vehicle providing of the specialized complex of the control of temperature/humidity is realized on a modern element base with module organization, which will be work in the real mode of time. The control of this system and all their knots executes a microcontroller CY8C29466-24PVXI (Cypress Semiconductor), which contains all necessary modules and is the reprogrammable system on a crystal.

Functional diagram of soft-hardware complex includes of analog and digital modules. Analog part contains of nanostructured thick-film temperature and humidity sensors prepared by us, and also modules of concordance of levels of their signals.

The electric principle scheme of proposed systems is shown in Figure1.

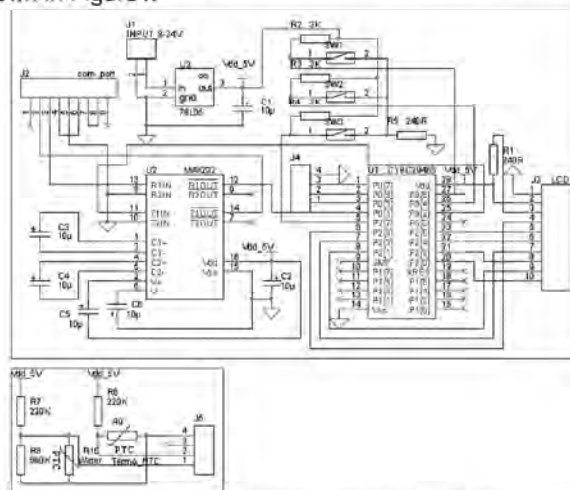


Fig.1. The electric principle scheme of proposed systems

Microcontroller CY8C29466-24PVXI is meant for measuring, calculation, working and information transfer executes through COM-port with the help of transformer of levels of MAX-232. Also for providing of leading out of the measured sizes the LCD display can be used. The supply of the system is provided by supply voltage from 8 to 24 volts, and current of loading more than 100 mA. Perception of information from touch-controls is performed from P0[3] and P0[5] ports and is digitised through built-in ADC. The microkeys are foreseen for the change of parameters and conclusion of information on a display.

The software is realized for a microcontroller CY8C29466-24PVXI (for the management by work of the system). The development is executed in PSoC Designer 5.0 by the C programming language.

Conclusion

Proposed system can be used for simultaneous temperature and humidity control in environment and medical application.

REFERENCES

- [1] Goede A.P.H., Burrows J.P., Energy and Environment, *The intimate link*, 40 (2009), No 4, 4-6
- [2] Hadzaman I., Klym H., etc., Temperature sensitive spinel-type ceramics in thick-film multilayer performance for environment sensors, *Acta Phys. Pol. A*, 117 (2010), No 1, 233-236