



6th International Conference on Nanotechnologies and Biomedical Engineering
Proceedings of ICNBME-2023, September 20–23, 2023, Chisinau, Moldova - Volume 1:
Nanotechnologies and Nano-biomaterials for Applications in Medicine

Combination Thermostated Vacuum Gauge

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https://doi.org/10.1007/978-3-031-42775-6_61

Abstract

To expand the measured pressure range, a prototype of a CVG-3 combination vacuum gauge using different physical principles of pressure measurement has been developed and constructed; it includes an electronic controller and a specially designed TTD-2 deformation–thermoelectric combination transducer. The transducer includes thermoelectric and deformation sensors. The sensitive element of the thermoelectric sensor consists of an electrically insulating film with heating and measuring circuits formed on the film surface by vacuum deposition; the measuring circuit is an array of thermocouples. The use of a thin insulating film in constructing the sensitive element has made it possible to significantly expand the measured pressure range toward high vacuum. The sensitive element of the deformation sensor is a silicon chip with a thin membrane in the middle; a tensoresistive bridge is formed on the membrane surface. The decrease in the membrane thickness has made it possible to increase the sensitivity of the sensor at pressures below 1 Torr. To decrease the pressure measurement error depending on changes in ambient temperature, the sensors are thermostated. Each sensor has an individual thermostat. The use of the thermocouple and tensometric principles of pressure measurement has made it possible to expand the measured pressure range from deep vacuum to atmospheric pressure, while maintaining high measurement accuracy. The large overlap of the measurement ranges of the sensors has made it possible to exclude jumps in the vacuum gauge readings upon switching from one physical principle of pressure measurement to another.

Keywords: vacuum gauge, pressure measurement, thermocouple, tensometric principles



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