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# Innovative Technologies of Distant Spectral Temperature Control

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**Abstract :** Optical thermometry has no alternative in many cases of industrial most effective continuous temperature control. Classical optical thermometry technologies can be used on available for pyrometers controlled objects with stable radiation characteristics and transmissivity of the intermediate medium. Without using temperature corrections, it is possible in the case of a “black” body for energy pyrometry and the cases of “black” and “grey” bodies for spectral ratio pyrometry or with using corrections – for any colored bodies. Consequently, with increasing the number of operating waves, optical thermometry possibilities to reduce methodical errors significantly expand. That is why, in recent 25-30 years, research works have been reoriented on more perfect spectral (multicolor) thermometry technologies. There are two physical material substances, i.e., substance (controlled object) and electromagnetic field (thermal radiation), to be operated in optical thermometry. Heat is transferred by radiation; therefore, radiation has the energy, entropy, and temperature. Optical thermometry was originating simultaneously with the developing of thermal radiation theory when the concept and the term "radiation temperature" was not used, and therefore concepts and terms "conditional temperatures" or "pseudo temperature" of controlled objects were introduced. They do not correspond to the physical sense and definitions of temperature in thermodynamics, molecular-kinetic theory, and statistical physics. Launched by the scientific thermometric society, discussion about the possibilities of temperature measurements of objects, including colored bodies, using the temperatures of their radiation is not finished. Are the information about controlled objects transferred by their radiation enough for temperature measurements? The positive and negative answers on this fundamental question divided experts into two opposite camps. Recent achievements of spectral thermometry develop events in her favour and don’t leave any hope for skeptics. This article presents the results of investigations and developments in the field of spectral thermometry carried out by the authors in the Department of Thermometry and Physics-Chemical Investigations. The authors have many-year’s of experience in the field of modern optical thermometry technologies. Innovative technologies of optical continuous temperature control have been developed: symmetric-wave, two-color compensative, and based on obtained nonlinearity equation of spectral emissivity distribution linear, two-range, and parabolic. The technologies are based on direct measurements of physically substantiated and proposed by Prof. L. Zhukov, radiation temperatures with the next calculation of the controlled object temperature using this radiation temperatures and corresponding mathematical models. The technologies significantly increase metrological characteristics of continuous contactless and light-guide temperature control in energy, metallurgical, ceramic, glassy, and other productions. For example, under the same conditions, the methodical errors of proposed technologies are less than the errors of known spectral and classical technologies in 2 and 3-13 times, respectively. Innovative technologies provide quality products obtaining at the lowest possible resource-including energy costs. More than 600 publications have been published on the completed developments, including more than 100 domestic patents, as well as 34 patents in Australia, Bulgaria, Germany, France, Canada, the USA, Sweden, and Japan. The developments have been implemented in the enterprises of USA, as well as Western Europe and Asia, including Germany and Japan.

**Keywords :** emissivity, radiation temperature, object temperature, spectral thermometry
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