

X-RAY RADIOGRAPHY SYSTEMS WITH IDENTIFICATION OF SUBSTANCES OF CONTROL OBJECTS AND THEIR FRAGMENTS BY DUAL-METHOD ENERGY

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For the effective implementation of measures in the field of security nowadays effectively used X-ray inspection systems, which are systems of digital radiography. X-ray inspection systems are used for a wide range of applications [1]: search and detection of explosives and explosive devices, baggage and hand luggage at airports and customs checkpoints, inspection of vehicles for the detection of items prohibited for carriage, e.t.c.

The physical principle of information about the characteristics of the object radiometric control can be divided into two fundamentally different directions [2]: measurement of the X-ray or gamma-radiation transmitted through the object and measurement of x-ray or gamma-radiation scattered into the object.

Complexes of digital radiography, operating on the basis of registration of transmission (last) radiation, have some significant drawbacks. The main disadvantage is the obligatory two-way access to the object of control, significant dimensions of the complex. This method has the additional constraints imposed by the need to comply with the radiation safety standards, especially as the object of control a person acts as the method provides a significant dose radiation load on the subject [3]. Low efficiency of the optical system limits the dynamic range (the number of shades of gray on the resulting image), and requires an increase in the exposure dose, which is not desirable for the majority of biological objects [1]. To solve these problems it is possible to use a flat panel detection applied with the scintillator (a substance having an ability to emit light upon absorption of ionizing radiation [4]). This solution allows, in some cases, reduce the size of the radiographic complex, to obtain an image of higher quality, and reduce the radiation load on the test object. On the positive properties of digital radiography systems include high sensitivity and high performance.

For the X-ray inspection with a one-way access to the object of research is needed detecting devices, which are based on the measurement of the parameters of the scattered radiation. Another advantage of this method is the ability to create systems for personal inspection, which will have low

background radiation. The disadvantages of this method are analyzed low sensitivity and low productivity.

One of the most important tasks facing the customs services and other safety services, is the identification of substances of which the test object or fragments consists [5]. By identification is meant determining supplies the material from which the object is made, to one of four groups: organic substances, metals with a small value of the effective atomic number metals, with an average value of the effective atomic number of metals and with a high effective atomic number. To solve this problem used dual-energy digital implementation of shadow radiography [6], which is called dual-energy method. The method is based on the algorithmic division of the contribution of various physical processes of interaction of X-rays with matter in the shadow digital images obtained for the two highest-energy X-rays [7]. When using dual-energy method, the results of primary processing of radiometric signals get two shadow digital radiographic image. The first of them carries the information on the density and thickness of the material object of the control, and the second also enclosed information and the effective atomic number of the substance of the object [8]. The proximity of the effective atomic number of the substance or object control characteristics associated with effective atomic number or reference characteristic is the main criterion by which the substance of the object of control is related to one of the classes of substances of the four classes. The problem of identification of substances of large objects are used dual-energy X-ray sources of high-energy radiation. As the high-energy X-ray sources, linear accelerators and electron's betatrons with maximum energy in the spectrum of the radiation in the range of 1 to 10 MeV are used [9]. The quality of the identification of substances subject control by dual-energy depends on the amount of displacement corresponding identification parameters [10], which are caused by the influence of a number of technical and physical factors in the initial radiographic image.

Variations in the chemical composition of the substance of the object of control leading to a change in the effective atomic number, and there is a significant estimation error density of the substance of the object. [11] By liquid objects of uniform density, the method of dual energy allows it to receive unbiased estimates, the objects with variations of density along the propagation vector of radiation, this method can lead to significant bias in magnitude [2].

The current method of dual energy with high-energy X-ray source is very common in the customs of different countries for the detection of illegal goods (smuggling). This proves the importance of the development issues related to inspection inspection systems at a higher level. The literature is

currently not fully investigated the possibility of control by dual-energy of various objects. For example, methods for finding the density of multicomponent objects require more detailed research, and the introduction of its results in the practice of customs and inspection control will improve the accuracy of the density measurement.

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