MODERN METHODS OF CONTROLLING TIGHTNESS OF SHELLS OF THE HEAT ELEMENT

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Introduction. One of the main parameters of safety of nuclear reactor (NR) of the nuclear power plant (NPP) is the violation of the tightness of shells of heat element (HE), which is the main element of the active area of NR. As the analysis [1 – 6] showed, modern methods of control do not track the dynamics of the process of damage and destruction of the HE shell and do not determine the criteria of the shell's depressurization in the real time mode which is a pressing task [1]. The following tasks are solved in the work: 1. Analysis of the existing methods of control of the heat element's tightness. 2. Development of new approaches and requirements to methods of control of the degree of tightness of HE. Materials. In the work were considered non-destructive methods, which control external and internal structure of shell HE at their operation [2 – 4]. Among the modern methods of control tightness of the shell HE it is possible to mark the following: 1. The capillary methods are based on the capillary penetration of the indicator liquids in the cavity of surface defects. Under the control of these methods, penetrating liquid is applied to the cleaned surface of the parts, which fills the cavity of surface defects. Then the liquid is removed, and the part that remains in the empty defects are detected by the help of a prolonger, which forms an indicator picture. Capillary flaw detection is not possible to use when monitoring HE in the process of operation [2, 3]. The process of detecting surface defects by the capillary method is shown schematically in the speaker in fig. 1. Fig. 1. The Control scheme of the capillary methods 2. The mas-spectrometric method is based on the use of the amount of helium as an indicator gas, which is injected under the shell of the HE, so with its help it is possible to reveal the process of the shell's depressurization, by the percentage content in the heat element exceeding the norm [5]. The principle of the control of the HE tightness with the gas-filled chamber method is shown in Fig. 2. Fig. 2. Structural and functional scheme of gas-filled chamber method From Fig. 2. We can see that a leak can determine the relative amount of helium coming from the HE, thus it is possible to identify small holes, cracks in the shell and welded joints of HE. As a drawback it is necessary to note that in the presence of significant size of all-round defects in the shells of HE, this method of control may miss significant indications, as during evacuation of all helium can leave under the shell of HE [5 – 8]. Discussion of results. Analysis of the existing methods of control of heat elements elements of heat elements assemblies of nuclear reactor of the nuclear power plant showed that they are used for control only of the external surface of the material of the shell of the HE and do not take into account changes of the internal structure of the surface of the shell of the HE. For this purpose the method of control on the basis of the machine fractal geometry, 37 surface defect penetrant developer indication H e a t element pump camera Leak-off Міжнародна науково-практична конференція «Якість, стандартизація та метрологічне забезпечення» which allows to take into account changes of geometrical parameters (external, internal, diameter and thickness of the shell) of the internal structure of the shell of HE is proposed in the work. Conclusions: 1. The current methods of control considered do not track the dynamics of the process of damage and destruction of the shell of HE and do not determine the criteria of the shell tightness. 2. The methods under consideration require improvement to determine the depressurization of the heat element shell during it`s operation in real time mode.

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