1.7.20. EXPERIENCE OF IMPLEMENTING THE METHOD OF ACOUSTIC EMISSION TEST OPERATION OF EQUIPMENT AT THE STATIC FRACTURE, CYCLIC FRACTURE AND STRESS-CORROSION CRACKING

Nefedyev E., Central Boiler and Turbine Institute (CKTI),
St.-Petersburg, Russia

Introduction. This report represents a part of our practice in developing the method of acoustic emission (AE) test operation of pressure vessels, pipelines and other important technical equipment.

The AE method is considered to be the most acceptable one of all the known non-destructive inspection methods for the realization of control over the process of construction fracture during the exploitation or testing.

However, the existing criteria for the estimation of fracture stage with the help of the AE method do not reflect clearly the physics of the process under control.

We will consider three basic and the most dangerous mechanisms of fracture: static fracture, cyclic fracture and stress-corrosion cracking.

Static destruction. Careful quantitative metallographic investigations are conducted with the aim of detecting the construction condition by analyzing the AE signals.

The criteria of early formation of fracture nucleus is suggested and it is not related to the sizes of AE radiating zone and over quite a wide range to the steel types, it is produced from.

It allows using it both at the study of samples fracture and at the control over the condition of steel constructions.

Cyclical destruction. The implementation of the present approach proved to be rather successful at the study of cyclic fracture of the samples with cracks.

At a later stage, we used the present method in our system of AE monitoring over the condition of the machine rolling mill 5,000. We defined the level of secure stress at which the cracks did not develop. But the practice of sheets at the given level of stress was impossible. Therefore, with the help of the present method we succeeded in monitoring for more than 10 years of the development of several cracks with the length up to 1.5 meters and nearly 40 mm depth and warned in time about the hop increase of growth rate of the given cracks.

Corrosion cracking. The stress-corrosion cracking is another dangerous mechanism of the steel destruction. It is known that at nuclear power stations the chloride embrittlement of material appears due to the effect of the heat-carrying agent of the primary and secondary coolant circuit. Caustic embrittlement is possible because of the pollution of the heat-carrying agent of the secondary coolant circuit.

Tests of welded samples were carried out to study the corrosion cracking resistance of the basic metal, as the crack resistant materials are usually exposed to this phenomenon if used in welded elements. The stainless steel 08H18N10T was selected as the subject of research. Currently, there is wide experience of using the given metal in manufacturing the equipment for nuclear power stations, and, in particular, for the pipe system of vapour generators. The steel tests on corrosion cracking or sustained corrosion resistance were conducted in the solution containing the chloride of ions and oxygen at the temperature of 300°.

Conclusions. The regularities that allowed describing the stages of fraction by the results of AE test operations were obtained.

The present research shows that the three most important cases of destruction: static fracture, cyclic fracture and stress-corrosion cracking can be analyzed by the AE method within the framework of a two-stage fraction model.