Diagnostic technique for aging thermal power plants at Tohoku-EPCO

Fumio Sato, Soji Hasegawa, Hiroyoshi Takeda
Tohoku Electric Power Co., Inc. Miyagi, Japan

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Abstract

It is very important to conduct a periodic inspection carefully so as to operate aging thermal power plants with high reliability. The residual service life is estimated based on the results of the inspection. One of the dominant damage mechanisms of high-temperature components such as boiler and turbine systems is creep. Highly damaged areas are located by the FEM analysis and damages of the areas are evaluated based on visible information of material surface texture. The correlation between visible information of surface texture and degradation of material strength has been examined. The residual service life of components can be estimated accurately based on the correlation. Samples for surface observation and destructive testing are obtained from used components of our aging plants. Thus, we think that the relation is accurate enough to estimate the residual service life of components.

Recently, at relatively new power plants, it is needed to estimate the residual service life accurately in order to reduce maintenance cost while ensuring high reliability. Therefore, we have been developing a more accurate FEM analysis system and a new non-destructive testing method to make diagnosis of plants more accurate.

In order to reduce maintenance cost such as replacement of steam turbine casings or rotors, a more accurate FEM analysis is needed. Usually, the physical property of material that does not deteriorate is used in the FEM analysis. But the physical property deteriorates during operation. We have been developing the FEM analysis system that is able to use deteriorated material properties to make the FEM analysis more accurate.

A new non-destructive testing method is needed to detect internal damage. When damage indices such as creep voids are observed on the surface of components, the damage of the components can be evaluated by relatively simple way such as observation of material surface. But at some parts such as welded portions of high chromium steel pipe, it is difficult to observe creep voids on the surface of the parts. In many cases, damaged area of the pipe which is made of high chromium steel tends to be under the surface. Conventional ultrasonic testing cannot detect the early stage of damage. In order to detect the early stage of damage under the surface, we have been developing the new ultrasonic method.