



THE INCREASE OF GEOTHERMAL TURBINE PLANTS' EFFICIENCY ON THE BASIS OF THE SURFACTANT ADMIXTURES' USAGE

Grigoriy Valentinovich Tomarov and Andrey Anatol'evich Shipkov
"Geotherm-EM", Lefortovskiy Val Street, Moscow, Russia
E-Mail: geotherm@gmail.com

ABSTRACT

The operation of geothermal turbine plants is followed by a damage of working surfaces of metal and a formation of deposits in a ductal part. It leads to the destruction of power equipment's elements, and also to the deceleration of turbines' power and to the electric power generation at the geothermal power plant. A change of physical and chemical properties of the geothermal heat carrier by the means of the surface-active substances' additives allows solving the problems mentioned above substantially. The developed criteria of a choice of the kind of surface-active substances provide the greatest efficiency of their application for the prevention of damages and formation of sediments in geothermal turbine plants. It is established on a criteria basis that the introduction of additives of a helamin to the geothermal heat carrier is a perspective way of the increase of geothermal turbine plants' reliability and efficiency of operation.

Keywords: a turbine plant, geothermal heat carrier, sediments, damageability, metal, surface-active substance.

1. INTRODUCTION

The significant economic damage during the operation of geothermal turbine plants is caused by the damages of the equipment and the pipelines elements subject to an erosion-corrosion, drop-percussion erosion, cavitation erosion, corrosion cracking of metal which is energized and subject to a parking (atmospheric) corrosion. The damage is also caused by a formation of salt sedimentations on the working surfaces of the ductal part of turbines [1-5] (Figure-1). It leads to the increase of the hydraulic resistance of the ductal part, to the power deceleration and the growth of a specific consumption of the geothermal steam for the turbine plant that eventually reduces the power generation at the geothermal power plant (GeoPP).

The practice of the use of the geothermal heat carrier in the power supply system shows that as a rule there are not usually enough constructive decisions at the creation of a such equipment to provide the effective protection of the metal of a working contour against the corrosive and erosive attack, and also to exclude the formation of salt sedimentations [6 - 14]. Therefore in addition it is expediently to apply various active ways of processes' management of stream's negative impact on the metal, including the change of the physical and chemical properties of the geothermal heat carrier [15-18]. While developing criteria of a choice of the surfactant for periodic introduction to the geothermal heat carrier it is necessary to consider the features of its influence on the processes of a realization of mechanisms of metal's damage and the formation of sediments.

2. RESULTS

On the basis of the analysis of the damageability of the equipment GEO PP, the regularities and processes of the dominating mechanisms of the metal's destruction

in one and - two-phase geothermal streams the main groups and concrete criteria which should be used at a choice of the surfactant optimum type of surfactant admixture (Figure-2) were defined.



Figure-1. The form of a nozzle lattice of the 1st step of the 25 MW geothermal turbine plant.

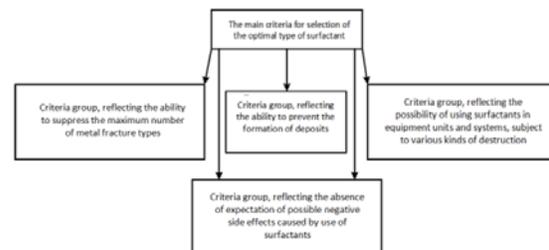


Figure-2. Criteria groups for the selection of surfactants.

The first group of criteria defines a real opportunity and efficiency of the suppression of possible bigger quantity of types of destruction of the equipment



and pipeline's metal under the influence of the geothermal heat carrier (Figure-3).

The second group of criteria reflects the properties which surfactant admixture must possess for the ensuring of cleaning of working surfaces from scurfs, and also to promote the prevention of the formation of scurfs in elements of the turbine plants (Figure-4).

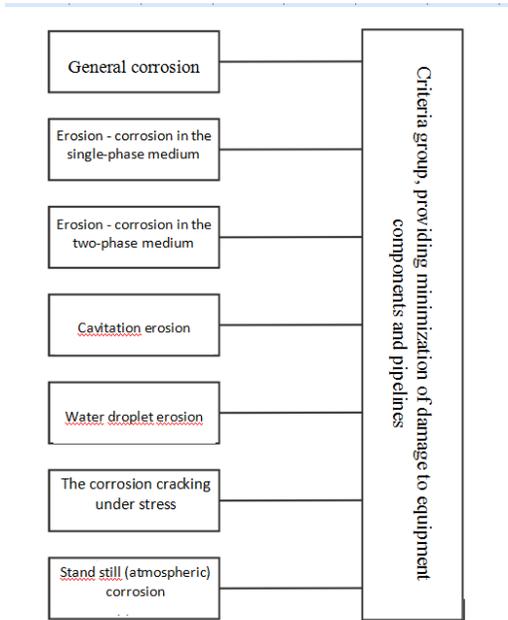


Figure-3. The list of types of destruction.

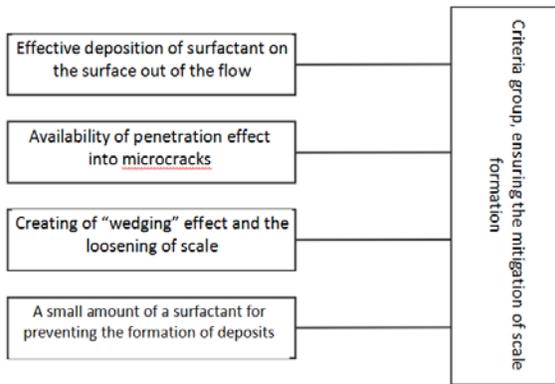


Figure-4. The list of criteria reflecting the surfactant properties.

A group of the criteria reflecting a possibility of the application of a correctional additive in various thermodynamic, hydrodynamic and water and chemical conditions with the list of types of the capital equipment of the geothermal turbine plant are presented in a Figure-5.

The practice of the application of surface-active substances testifies that their use in some cases can be

followed by the negative phenomena. In the Figure-6 some negative effects a manifestation of which would be undesirable are shown. The high expense and the cost of reagent can also be a restriction for the application.

In a result of the conducted researches it was established that helamin possesses a property allowing to wash scurf, and also to interfere with its appearance. On the one hand the property of the helamin to do a surface of a hydrophobic type (that creates the conditions interfering the sedimentation and sticking of impurity to a surface) is in the cornerstone of the manifestation of such an effect, and on the other hand it loosens already formed scurf (that leads to an washing and carrying out of firm formations in a geothermal contour).

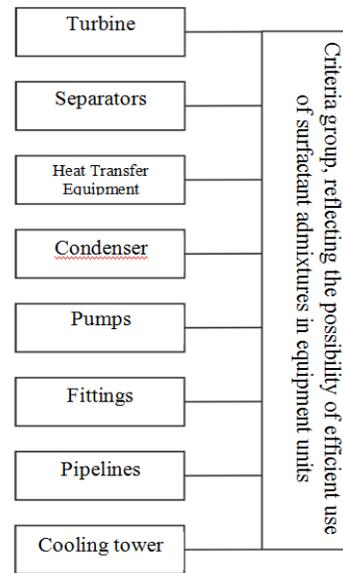


Figure-5. List of equipment, subject to various kinds of destruction.

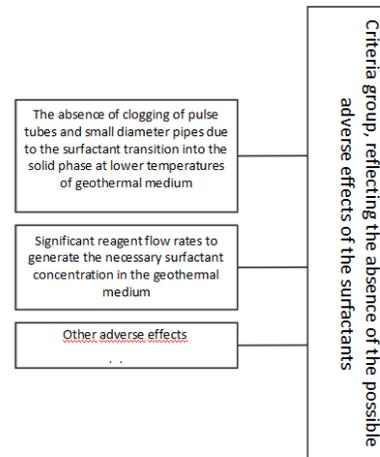


Figure-6. The list of possible adverse effects associated with the use of surfactants.



Follows from the above that additives of a helamin smear to be recommended for minimization of manifestation of various mechanisms of damage of metal and the prevention of formation of deposits in a geothermal contour of power stations. Works on an experimental assessment of efficiency of introduction of additives of a helamin for the prevention of damageability of elements of the equipment and formation of deposits in actual practice of operation of geothermal turbine plants are planned.

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