

NEW DIRECTIONS IN LIQUID QUENCHING MEDIA DEVELOPMENT

N.I. Kobasko¹, A.A. Moskalenko², P.N. Logvinenko^{3,4}, V.V.Dobrivecher¹

¹ITL, Kiev, Ukraine, ²ITTF NASU, Kiev, Ukraine, ³IHVS NASU, Kiev, Ukraine,

⁴TOV Barkor, Kiev, Ukraine

tel. 453-28-93, e-mail: admin@ittf.kiev.ua

The purpose of the study is to analyze the known developments of effective quenching media and to conduct new experimental and design studies to create qualitatively new in composition and physical mechanism for intensifying cooling and structural transformations of the hardened metal, as well as corresponding modern methods of diagnostics and control of heat treatment modes.

Results. The essence of the new direction is that instead of the well-known quenching media with the addition of surface-active substances (surfactants), which change the dynamics of thermal hardening by increasing the critical densities of heat fluxes, achieve the effect of accelerating metal cooling by using small additives of water-soluble polymers. In such environments, a thin insulating layer forms on the surface of the hot metal, reducing the temperature at the interface with the liquid. As a result, in the range of temperatures at which austenitic-martensitic reorganizations of the structure and hardening of the metal occur, the film boiling regime is eliminated. Film boiling during quenching slows down martensitic transformations in the metal. It lowers its strength and also creates the threat of double warping of machine parts of complex shape. In the studied water-polymer environments, a good additional effect was obtained when using active hydrodynamic emitters that generate oscillations in a liquid at frequencies that coincide with the resonant frequencies of the vapor films. Such oscillations increase the instability of the vapor film up to its destruction, as a result of which a high quality of heat-strengthened products is achieved.

Findings. The novelty of ideas to improve the efficiency of heat treatment technologies are protected by two patents of Ukraine; a new monograph published by Lambert Academic Publishing is devoted to this topic; "Barkor" with the possible subsequent implementation in the United States. Positive prospects for using the results confirm the feasibility of continuing and developing research in this field of applied research.