СЕКЦІЯ 5
«ЗВАРЮВАННЯ ТА СПОРІДНЕНІ ПРОЦЕСИ І ТЕХНОЛОГІЇ»

УДК 621.791.923.6

A. Kostin, Cand. Sc., associate professor
V. Martunenko, Cand. Sc., associate professor
Admiral Makarov National University of Shipbuilding,
Nikolaev, Ukraine.volodymyr.martynenko@nuos.edu.ua
A.Maluy, Engineer
Zorya-Mashproekt Gas Turbine Research and Development Complex, Nikolaev,Ukraine

KMKH AND KMKHS ALLOYING WEAR-RESISTANT MATERIALS TEMPERAURE INTERVAL

The high-resistant nickel alloys of ChS88U-VI type have been strengthened by disperse releases of γ′-phase Ni_3(Al, Ti).They are used for the ship turbine blades production. This phase has the tendency to the coagulation at the process of the contact interaction at the high temperatures ,and it activates the processes of the surface layer oxidation, and it activates of its rupture. In this connection, the protection of the gas turbine engine blades contact surfaces from the high-temperature wear is the actual task of shipbuilding.

The well-known wear-resistant alloying materials for ship gas turbines can be classified in accordance with the melting temperature: up to and more than 1220±10ºC (the temperature of the base metal irreversible softening). The most difficult problem is the development of the alloys with the melting temperature which is up to 1220±10ºC.It provides the possibility of their laying on the work surfaces in the liquid state. Their high adhesive activity is required.

The main task of the adhesive active wear-resistant and high-resistant composite alloying materials development is the support of the necessary level of their wear resistance at work temperatures (up to 900ºC), the ability to stand the short-term thermal loads in the oxidizing medium at temperatures up to 1150 ºC and at resistance to the high-temperature salt corrosion, and the possibility of their application like melt on the working contact surfaces which have been heated at temperature which is not more than $1220^{\pm 10}$ ºC.

KMKh and KMKhS new wear-resistant materials have been developed at Admiral Makarov National University of Shipbuilding together with Zorya-Mashproekt Gas Turbine Research and Development Complex which meet the specified requirements. The chemical composition of these materials is shown at table 1.

Table 1 – KMKh and KMKhS alloys properties [1, 2]

Alloy brand	Chemical composition, % mass.							Temperature of melting, ºC
	Co	Cr	Mo	Si	B	Ni	Cr_3C_2	
KMKh	base	17-18	27-28	2,8-3,2	0,8-1,2	–	–	1185^{+5}
KMKhS	base	17-18	27-28	2,8-3,2	0,8-1,2	2,8-3,2	1,9-2,1	1165^{+5}

The optimization of the melting temperature and the temperature interval of the alloying materials crystallization have been executed with the use of the high-temperature differential thermal analysis method. The characteristic thermograms of melting and crystallization of KMKh and KMKhS alloys are shown at pic. 1.

The specified data of the thermal analysis at pic. 1. testify that KMKh and KMKhS alloys at the optimal relation of Si and B in these alloys, KMKh and KMKhS alloys have only one thermal effect on the thermal curves of heat and cooling. The specified effect identifies the solidus temperature for KMKh alloy which is equal to 1185^{+5} ºC and for KMKhS alloy it is equal to 1165^{+5} ºC. At the deviation from the recommended relation , the stability of the phase composition is breaking.

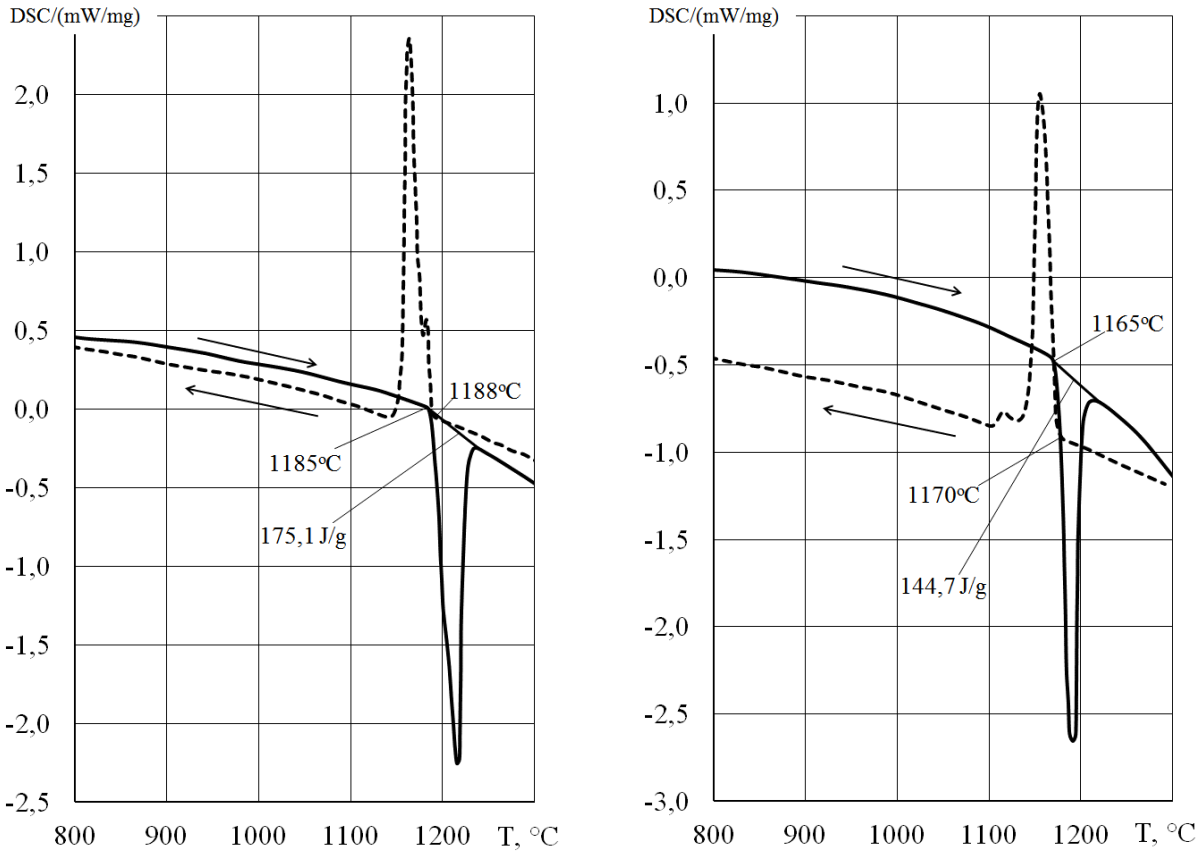

Fig. 1 – The differential scanning calorimetry of KMKh (a) and KMKhS (b) alloys .

The possibility of the phases reaction with the formation of the nonequilibrium phases is appeared. As a result the additional effects are appeared on the thermal curves. It leads to the decrease or the increase of these alloys melting temperature.

The executed researches have shown that KMKh and KMKhS alloys are in accordance with the specified requirements concerning their melting temperature and the duration of crystallization temperature interval.

List of references

1. Kostin A., Martunenko V., Maluy O., Butenko A. *Znosostiykiy zharomitsniy kompozitsiyniy splav na osnovi kobaltu* [Wear resistant heat-resistant composite alloy based on cobalt] Patent UA, no. u 2015 12664, 2015.

2. Kostin A., Martunenko V., Maluy O., Butenko A. *Zharomitsniy znosostiykiy kompozitsiyniy splav na osnovi kobaltu* [High-temperature composite wear-resistant alloy based on cobalt] Patent UA, no. u 2016 02906, 2016.

УДК 621.791.019

Гаєвський О.А., канд. техн. наук, доцент
Національний технічний університет України «КПІ ім. І.Сікорського», ggoa@ukr.net

ЗМІНЮВАНІСТЬ ШИРИНИ ШВА ПРИ ЗВАРЮВАННІ У СУМІШІ ЗАХИСНИХ ГАЗІВ

Змінюваність властива для всіх контрольованих характеристик зварних швів. Врахування змінюваності характеристик виробів є однією з вимог сучасних міжнародних стандартів з управління якістю у зварювальному виробництві. Для врахування змінюваності при прийнятті обґрунтованих рішень в умовах виробництва застосовують