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Practical use of activation energy of wear resistance and compatibility of tribocouple materials

*Practical use of activation energy values II-nd ($E^{м}$) and III-rd (E^{p}) of the stage of triboreaction (TR) obtained for the wear of steel ШХ15 in hydrocarbon media (aviation fuel of PT, TC-1, TC-1 * for long-term storage, АМГ-10 oil, and also E^{p} in the reciprocating motion.The obtained results confirmed the correctness and efficiency of the kinetic model of normal mechano-chemical wear and the calculation and experimental technique for estimating the kinetic and energy-activation criteria for assessing wear resistance and compatibility materials for tributylism*

Recently, it has became popular to use energy criteria for assessing the wear resistance and compatibility of tribocomponent materials, in particular, the activation energy of destruction Uoσ [1]. But at the first acquaintance with this work it becomes clear that by determining the activation energy of destruction Uoσ by extrapolation U(σ)~f(σ) according to the author, the activation energy values are very subjective and very conditional, since extrapolation is an approximate determination of the values of the function f(x) at the points x lying outside the interval (xo, xn) from its values in points $x_o<x<\ldots<x_n$ [2].

Whereas a three-stage model of normal mechano-chemical wear is known [3] and a calculation-experimental technique for estimating the kinetic and energy-activation criteria for evaluating the wear resistance and compatibility of tribocouple materials [4]. As per to the kinetic model and the calculation and experimental methods, the activation energy of wear activation (E^{p}_{a}) – III the stage of triboreaction (TP) and chemical modification ($E^{м}_{a}$) – II stage TR steel ШХ15 in aviation fuel PT [4,5], TC-1 [6], aviation oil hydraulic АМГ-10 [3,5], (E^{p}_{a}) в TC-1* long-term storage [7], as well as the values of the wear activation energy for reversible friction of the alloy BK-8 over steel 45 [8] with an established accuracy, i.e. with a confidence interval.

It is promising to use the entropy approach to solving problems of wear resistance and compatibility of triboconjugation materials, which is particularly successful in the works of A. V. Goncharenko [9-18].

The values obtained E^{p}_{a} и $E^{м}_{a}$ supplemented with a complex matrix criterion for assessing the wear resistance and compatibility of tribocouple materials, which takes the following form:

$$\begin{vmatrix} E^{M}_{PT} = 1{,}14; & E^{P}_{PT} = 21{,}28 \\ E^{M}_{TC-1} = 2{,}96; & E^{P}_{TC-1} = 20{,}31 \\ E^{M}_{AM\Gamma} = 9{,}39; & E^{P}_{AM\Gamma} = 52{,}12 \end{vmatrix}$$

Values $E^{м}$ and E^{P} are defined in kJ / mol.

Conclusions:

1. The obtained values of activation energies II-nd ($E^м$) and III-rd (E^p) The stages of the TR confirmed the adequacy of the kinetic model and the efficiency of the calculation and experimental methodology for estimating the kinetic and energy-activation characteristics of the two stages of the TR.

2. The obtained values of $E^м$ and E^p in the aviation fuel of PT and TC-1, as well as of АМГ-10 oil supplemented the complex matrix criterion of wear resistance and compatibility of tribocouple materials [4].

3. Insignificantly better antiwear properties of jet fuel PT in comparison with similar properties of jet fuel TC-1, which was impossible to establish using traditional criteria for assessing wear resistance ($d_{изн}$ – diameter of wear spot of ball ШХ15 of friction machine КІЕСА-2 or УПС-01) [6].

4. It has been experimentally established that it is possible to use E^p during reciprocating motion [8].

5. The obtained values of $E^м$ and E^p added to the data base of the wear resistance of steel ШХ15 and antiwear properties of jet fuel of PT, TC-1 and TC-1* for long-term storage and АМГ-10 oil [4,5,6,7].

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