dichloroethane on model alloys: Ni-Co (a), Ni-Cu (b), Ni-Cr (c).

In order to make a step towards the development of recycling technology we have created a demonstration setup to test the catalysts at scale-up regime. Preliminary tests on Ni-Cr bulk alloys showed specific productivity of reactor at level of about 70 g(CNF)/g(cat)*hour, with the selectivity towards carbon more than 60%. The resulting CNFs are characterized by high surface area (up to 400 m^2/g) and unique segmented structure (Fig.1), which allows one to consider such product as promising modifying additive in composition of cement stone and lubricants.

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V.L.Belyaev
A.A. Shalaginov

HIGH-CURRENT CONTACT SYSTEMS USING ELECTRICALLY CONDUCTIVE LUBRICANTS

National Mining University, Saint Petersburg

The works is dedicated to study of high-current contact systems (HCCS) of electrolysis enterprises of chemical and metallurgical industries.

The goal of the present work is the study of contact transitions of heterogeneous contact materials using modern electrically conductive lubricants EPS-90, EPS-150, EPS-200, EPS-300+, EPS-SK, the measurement of decrease of voltage and temperature of heating the contact transitions of different contact connections on the experimental plant not using or using the electrically conductive lubricants, using different amount of bolted connections, different types of welded connections and so on.

Electrically conductive lubricants (ECL) represent the compositions of some lubricating materials with electrically conductive powder fillings.

EPL are purposed for lowering and stabilization of contact resistance in any metallic bolted contact connections of power, lighting equipment, communication systems and essential energy saving.

The advantages of ECL are as follows: lowering of contact resistance, stabilization of contact resistance; increase of operating reliability of electrical equipment; increase of operation time of electrical equipment; energy saving at the industrial enterprise; fire-safe coating of metal contacts; anticorrosion coating of metal contacts.

When using ECL the current distribution in parallel branches of HCCS becomes more homogeneous, the contact resistance lowers depending on condition and materials of contact surfaces, and its stability over time increases. Besides, sealing and reliability of HCCS to the sealing characteristic of ECL and increase of their thermal and electrical stability are increasing. The latter is caused by the following: sufficient fluidity of composition provides for its extrusion in the contacting zone; introduction of metallic electrically conductive powder with small-sized particles into the neutral lubricant leads

to filling up of micro-cavities of the touching contact surfaces and increase of contact area (in spite of the higher specific resistance of ECL, then of main conductors of materials – copper, aluminum), as well as to approximation of values of expansion coefficients of contact materials and the lubricant.

When using ECL it is not necessary to use other scarce and expensive stabilization means of contact resistance: copper-aluminum transition parts, plate springs, metal coats of contacting surfaces and so on.

Several kinds of contact transitions were studied: copper-copper, copper- aluminum, aluminum - aluminum, copper- copper-clad aluminum, aluminum - copper-clad aluminum and so on. All buses were of size: 54 x 10 x 147. Nominal current rating is 600 Amp.

The object of study were 5 types of modern electrically conductive lubricants EPS-90, EPS-150, EPS-200, EPS-300+, EPS-SK, that were applied on the preliminary protected contact surfaces of buses, and the bolts tightened using the instant indicator key type DK-25 in accordance with GOST 10434-82. So, the value of torsion torque at tightening bolt M12 should correspond to 60-70 Nm; M16 – 90 – 100 Nm; M20 – 120 – 130 Nm; M24 – 200 – 220 Nm; M30 – 300 – 340 Nm; M36 – 360 – 380 Nm;

The millivoltmeter was used to study the values of voltage drop, and the digital, laboratory thermometer was used to define values of heating temperatures. This data were read from the studied contact connections during several months and were recorded in the test protocols.

Based on the obtained data the graphical curves of contact resistance and heating temperatures from the time were drawn, showing that contact connections where ECL was used are favorably compared with contact connections without ECL, which in conditions of manufacturing will lead to significant decrease of consumed capacity and economy of electric energy. So, 1 kg of electrically conductive lubricant during 1 year saves the electric energy at general purpose industrial enterprises up to 10 000 kW, at energy-consuming enterprises – up to 100 000 kw-hrs.

The laboratory tests of ECL development prototypes showed, that they are simple to mount and service, reliable at operation, have minimal contact resistances and electrical energy losses and longer service life in comparison with the contact connections without using the electrically conductive lubricants.

V.L. Belyaev
A.A. Shalaginov

MODERN HEAVY-CURRENT SHUNTING BREAKERS

National Mining University, Saint Petersburg

Nowadays, the design of heavy-current electrical apparatuses is especially actual for their usage in power-consuming industries, for example, in electrolysis plants of enterprises of chemical and metallurgy industry, where current flows through in-series electrolyzers,

and current is measured in dozens and hundreds thousands amperes with a voltage of 400-500V. Heavy-current shunting breakers (HSB), connected in parallel to electrolyzers, are used for the purpose of periodic examination and repair of each electrolyzer without interrupting the operation of the rest. In case of HSB contact closure, load current flows directly through it, while the eletrolyzer, in these circumstances, can be shut off.

At present, series-produced HSB of B-61 type for load current of 63 kA completely dissatisfies customers in consequence of using of hard-to-find and expensive silver, very limited operational resource during the interrepair period — not more than 20–30 switch on/ switch off (ON – OFF) operations, unreliability of flexible copper joints, complexity of breaker's repair in the conditions of active manufacture and the increase of rated current of electrolysis devices.

It is known, that electrolysis devices are already operated on load current of 100 kA. New types of electrolyzers are being designed for load current of 150 kA and 250 kA. Therefore, demand for using of HSB significantly increases, moreover, there is a necessity to change silver contacts to composition and liquid-metal contacts (CLMC) on the basis of gallium and it's alloys.

Different modifications of HSB and CLMC for various load currents and with natural and water cooling were designed, as a result of long-term researches and engineer developments, manufacture and test of prototype model of HSB by orders from chemical industry plants.

Specifications of several types of designed HSB are listed in the Table 1.

Type of device Engineer factors	VSh-400 CLMC	ShaG-500 CLMC	V-61 CLMC	V-75 CLMC
Rated current, kA	40	50	65	75(100)
Rated voltage, V	100	100	100	100
Rated voltage to ground, V	400	400	400	400
Main contact materials	Composition	Composition	Composition (in nitric area)	Composition (in nitric area)
Cooling (cooling water flow, l/h)	Natural air	Flowing water (750)	Flowing water (1000)	Flowing water (1500)
Device drive	Manual (pneumatic)	Manual (pneumatic)	Manual (pneumatic)	Manual (pneumatic)
Number of commutations during interrepair time	100	100	100	100
Sizes, dimensions, mm	780x758x700	-	621x480x815	621x480x815
Weight, kg	400	-	230	300

Production testing of prototype samples of HSS showed that they are simple in assembly and maintenance, reliable during operation, obtain little power consumption and long service life in comparison with series-produced breaker V-61.