ANALYSIS OF THE DIELECTRIC STRENGTH OF THE LIQUID DIELECTRIC

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One of the main indicators characterizing the insulating properties of transformer oils is their electrical strength: $E = \frac{U_p}{h}$, where U_p is the breakdown voltage; *h* - is the distance between the electrodes.

Dielectric strength for liquid dielectrics is not directly related to the chemical structure. The mechanism of breakdown in a fluid is affected by a very close arrangement of its molecules, as compared with a gas. Impact ionization, which is typical for gases, is impossible in a liquid dielectric.

The electrical strength of liquids depends on the amount of gas in these liquids. Also, the dielectric strength depends on the state of the surfaces of the electrodes to which the voltage is applied. Breakdown in a liquid begins with the breakdown of small gas bubbles.

The gas has a dielectric constant much lower. Therefore, the tension in the bubble is higher than in the surrounding liquid. In this case, the electrical strength of the gas below. Discharges in the bubbles lead to the growth of bubbles, and eventually, as a result of partial discharges in the bubbles, a breakdown of the liquid occurs.

Impurities play a large role in the mechanism of development of the breakdown of liquid dielectrics. Consider, for example, transformer oil. Soot and water, as conductive inclusions, reduce the electrical strength of transformer oil.

Water, though not mixed with oil, but the smallest droplets of it in oil under the action of an electric field polarize, form chains of increased conductivity, as compared to the surrounding oil, electrical conductivity, and as a result, the chain breaks down the oil.

To determine the electrical strength of liquids, in laboratory conditions, electrodes are used in the form of hemispheres, the radius of which is several times greater than the distance between them. In the gap between the electrodes a uniform electric field is created. Typical distance is h = 2.5 mm.

Pure transformer oil, free from water and other impurities, regardless of its chemical composition, has high electrical strength, sufficient for practice (more than 210 kV/cm)

In Ukraine, for transformer oil on equipment from 330 to 500 kV, breakdown voltage should not be less than 45 kV.

To increase the dielectric strength of a liquid dielectric, you must: clean the liquid from solid conductive particles such as coal, soot, etc.; eliminate water from a liquid dielectric; degassing the liquid (vacuum); increase the pressure in the fluid.