THE MEANING OF THE TOPIC "ELECTRIC FIELD" IN FIRE SAFETY: THE ACCOUNT OF ELECTROSTATIC PHENOMENA WHILE ENSURING FIRE SAFETY

Dadakhon Kamiljanovich Nasriddinov
Researcher Department of General Physics of National University of **UZBEKISTAN**

ABSTRACT

This article describes the importance of the topic "Electric field" in the field of fire safety and the consideration of electrostatic phenomena in ensuring fire safety

Keywords: Electric field, fire safety, static electricity, charges, danger of static electricity, measures of protection against static electricity.

INTRODUCTION, LITERATURE REVIEW AND DISCUSSION

During the years of independence, a new continuing education system was created in the Republic of Uzbekistan on the basis of the National Personnel Training Program and the Law on Education. Currently, according to the third stage of this program, the content of education as a whole is gradually improving in order to ensure the training of highly qualified competitive personnel. This task also applies to the subject of physics. For this purpose, based on the modern requirements for the training of highly qualified personnel in fire safety, it is an urgent problem to study and analyze the content of the physics course at the Fire Safety Institute (IPB) of the Ministry of Internal Affairs of the Republic of Uzbekistan.

Static electricity is the electricity of friction that occurs: during the friction of dielectrics against each other, dielectric against a conductor, during crushing of dielectrics, when the dielectric strikes against the dielectric, dielectric against the conductor, when the dielectric ruptures.

Static electricity charges arise, accumulate and disappear slowly. In practice, dielectrics with a relative dielectric constant $e < 10$ are prone to electrification, however, under certain conditions, some dielectrics become prone to electrification even with a value of $c > 10$. For example, ethyl alcohol has a value of $e = 22$, but with an increase in temperature it is prone to electrification. Under production conditions, many processes are accompanied by the formation of charges of static electricity. Sometimes these charges drain into the ground or neutralize, in other cases they accumulate, creating high potentials, sometimes reaching tens of thousands of volts.
Static charges occur:

- when transporting liquid dielectrics through pipelines;
- in tanks with petroleum products when they are filled or emptied;
- with a freely falling stream or with vigorous mixing of oil products in a gas-vapor space charged particles of hydrocarbons are formed in the form of fog. Their electric field, overlapping the field created by the charges of the liquid, can lead to the appearance of high potentials and to a discharge;
- in the production of rubber glue in glue mixers, mass mixers, charges reach up to 30 kV. Moreover, these charges cannot transfer to a grounded case, since a dry adhesive film is formed on the inner surface of the case;

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- when rubbing cotton, kapron and viscose fabrics with rubber glue on the lubrication machines, where the charges on the material and on individual nodes of the machine can reach 26-28 kV;
- during the work of weaving, spinning machines; when moving paper (on paper machines, printing houses, photocopiers);
- in the production of various types of plastics;
- when moving gases through ducts.

In pneumatic transport, the electrification of transported particles occurs throughout the line, and the discharge occurs in containers (bunkers, cyclones, etc.), where due to sedimentation of particles, the bulk density of charges sharply increases, which leads to an increase in the electric field strength to high values.

Static charges can occur:

- when working with flushing liquids; when rinsing cleaning materials in the washing liquid;
- when squeezing cleaning materials; during operation of belt transmission gears;
- when wearing clothes made of nylon, nylon, lavsan, silk and in many other cases. (1)

To measure the potential value of a charged body, electrostatic light meters are used. They allow you to measure the field strength without connecting the device to the source of charges. The intensity determines the potential and charge.

Danger of static electricity. Static electricity damages products, spoils raw materials, slows down the production process, and may cause an explosion or fire. The fire hazard of static electricity is manifested if a discharge occurs in a combustible medium and the thermal energy of the discharge is not less than the minimum flammable energy for a given combustible mixture.

Protective measures against static electricity. Protection against charges of static electricity is carried out in rooms with explosive and fire hazardous areas and installations where substances are used and obtained that have a specific volume resistance of p> 10 Ohm-cm. Fire measures are carried out in two main directions: preventing the formation of charges with high potential or preventing the discharge with the formation of sparks. These measures are prescribed taking into account the fire hazard of technological processes and their features. (2)

1. The easiest and most reliable way is grounding. In all cases when grounding is a sufficient means of protection against static electricity, it is recommended to resort to it. To protect against static electricity discharges, all metal equipment, gas holders, gas pipelines, oil pipelines, coal conveyors, discharge and filling devices located both indoors and outdoors and designed for processing, storage and transportation of flammable liquids, combustible gases and dusty combustible products shall be grounded at least at two points.
2. General and local humidification of air in hazardous places of rooms up to 75% relative humidity and above or humidification of the surface of electrifying material can be done by evaporation of water from open surfaces or by releasing steam into the room. Humidification is used for rubberizing fabrics, in weaving and spinning workshops, where humidification is also necessary according to the technological process.
3. Filling apparatus, containers, enclosed transport devices and other equipment with inert gas. The use of materials that increase the conductivity of dielectrics. For example, ceramic dielectrics usually have a negative temperature coefficient of resistance. Despite this, in many cases the presence of high dielectric constant is very desirable, therefore, ceramic dielectrics are widely used. (3)

Since the temperature of most dielectrics rises during operation, the insulation resistance drops rapidly. This leads to an increase in leakage current, contributing to further heating. In the end, when heat is generated faster than it has time to dissipate, a condition called thermal collapse or thermal breakdown can occur. Then the dielectric ceases to fulfill its functions and may even catch fire.

The electric current j through the dielectric is proportional to the electric field E (Ohm's law): $j = \sigma E$, where
σ is the conductivity of the dielectric. However, in sufficiently strong fields, the current rises faster than according to Ohm's law. At a certain critical value of EPR, an electrical breakdown of the dielectric occurs. The value of EPR is called the dielectric strength. During the breakdown, almost all of the current flows through a narrow channel.

In solid dielectrics, thermal and electrical breakdown are distinguished. During thermal breakdown, with increasing j, the dielectric temperature increases, which leads to an increase in the number of mobile charge carrier's q and a decrease in p. In electric breakdown, with an increase in the field E, carrier generation under the action of the field increases. In dielectric, breakdown is promoted by inevitable inhomogeneity's, since in places of uncertainty, the field E may increase.

The current density in the channel can reach large values. This can lead to destruction of the dielectric: a through hole is formed or the dielectric is melted along the channel; chemical reactions can occur in the channel. All this leads to a fire hazard.

Thermal effects can greatly influence the choice and use of insulating materials. Key factors to consider include:

1. melting point (for example, for wax in paper capacitors);
2. aging due to heating;
3. The maximum temperature that the material can tolerate without serious loss of the desired properties;
4. flash point or flammability;
5. resistance to occurrence of electric arcs;
6. special heat capacity of the material;
7. specific heat resistance;
8. coefficient of thermal expansion;
9. freezing point of the material.

The mechanical properties of dielectrics to a certain extent determine how suitable a solid material is as an insulator: as a rule, the tensile strength, bending strength, separation strength, compressive strength are important.

Most solid insulators are, to one degree or another, inelastic, and many are quite fragile; therefore, it is necessary to take into account such features as compressibility, deformation under the influence of bending force (bending stress), impact strength and tensile strength, tensile strength, workability and ability to bend without deformation.

Capacitors used in practice are characterized by dielectric material. The main types of capacitors include: alternating air, mica, paper, ceramic, plastic, with titanium dioxide and electrolyte.

Liquid dielectrics used for insulation include refined mineral oils, silicone fluids, and synthetic oils such as chlorinated diphenyl. Liquid dielectrics are mainly used as filling and cooling media for transformers, capacitors and rheostats; insulating and arc extinguishing medium in switchgears such as a circuit breaker and as an impregnating substance of absorbent insulation.

For example, transformers, circuit breakers, capacitors, and insulation cables use wood, graphite, paper, or pressed cardboard impregnated with a liquid dielectric. (4)

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