

Overview

This symposium was organized to update information on the important role of petroleum-based oil as an insulating and heat transfer agent in electrical apparatus.

The properties of these insulating oils are of vital importance to the service life of electrical equipment and have become increasingly important as operating voltages have increased to 500 kV and above and internal equipment spacings have decreased. The papers in this symposium have been directed towards the changing requirements of the insulating media as demanded by the changing design of the equipment, and they are of particular value to three main groups: the refiners of the oil; the manufacturers of the electrical equipment; and the end users (principally the electric utilities).

The papers in this book address the factors involved in the manufacture and use of the product that will meet these stringent requirements.

From the refiners' standpoint, the papers discuss how the crude oil is selected and what must be done to produce an end product with high dielectric strength, heat transfer capability, low-temperature pour point, resistance to oxidation, and long service life. These factors determine the specifications of the product.

From the users' standpoint, the papers discuss the significance of these specifications and test methods to determine if the specifications have been met, as well as tests to check the condition of oil after use in the equipment. Included is the very important diagnostic test for electric equipment in service, the analysis of dissolved gases in the oil.

Of special interest is section 5, which is devoted to a relatively new problem caused by electrostatic charges built up in the oil due to forced cooling in large transformers.

This volume is of value to all who refine or use insulating oils because it addresses the latest technologies involved.

The first section of this book, "Refining and Specification Limits," addresses methods used in refining crude oil to produce a product which is suitable for both electric insulation and heat transfer. Included is the problem of handling and shipping the product once produced. Contamination can occur from tank cars and drums that are not completely devoid of foreign materials or not properly sealed. The paper by Manger, which discusses cross contamination with polychlorinated biphenyls (PCB), is included to describe a specific problem. This paper updates the local and federal regulations dealing with PCB contamination.

The second section, "Significance of Application," addresses the reasons behind the various specifications for insulating oils and the significance of these specifications to the users.

The third section, "Analysis of Oil," discusses the methods of analysis to determine if these specifications have been met. There are two conditions to be considered: (1) analyzing new oil as shipped; and, perhaps more important, (2) the analysis of oil after certain periods of time in the electrical equipment to determine deterioration and predict further usefulness of the oil.

The fourth section, "Dissolved Gas in Oil," discusses the analysis of gases dissolved in oil and the significance of various gases to the condition of the electrical equipment involved. This is a very useful diagnostic test, particularly to monitor the performance of large high-voltage transformers.

The fifth section, "Electrostatic Buildup in Transformer Oil," perhaps one of the most provocative, has to do with a recent problem that has arisen in large transformers where the pumping of the oil is required to limit the temperature rise in the transformers. Pumping a liquid with high dielectric strength and very low quantities of moisture over various materials in the pump

and in the insulating material, in many cases, has caused an electrostatic charge buildup in the oil and has resulted in electrical failure in several large transformers throughout the country. The papers in this section present the latest information on this phenomena. There is much more to be learned of this complex process, and much work is being done throughout the country to try and solve this problem.

The papers in this book should provide the reader with the latest technologies in selecting and handling this very important insulating media for electric equipment. This is a very significant area for equipment designers. Large capacity size and weight of electrical equipment is of vital importance, resulting in smaller internal spacings requiring the best dielectric material available.

ASTM Committee D27 on Electrical Insulating Liquids and Gases is continually working to update this material, improve test procedures, and investigate newly refined products that appear on the market. Refiners are continuously producing new insulating oils from petroleum crude oil. In addition, manufacturers are continually producing synthetic insulating fluids. Committee D27 on Electrical Insulating Liquids and Gases addresses these new products as they come on the market.

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