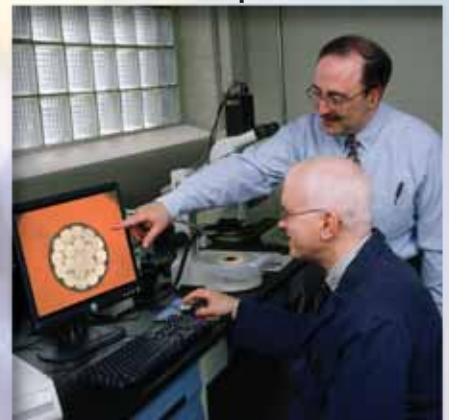


MATERIAL RESEARCH at OKONITE



**THE
OKONITE
COMPANY**

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Material



Throughout its nearly 130-year-plus history, one of the cornerstones of The Okonite Company's philosophy of operation has been to offer its customers the highest quality, best performing materials for cable insulations and jackets. The materials are formulated in a fashion so that the optimum balance of both physical and electrical properties are obtained. It has always been Okonite's policy to formulate and mix its premium EPR insulation, semiconductive screens and jacket materials in-house. It has been our experience that in-house formulation and compounding is the best, if not the only way, to obtain and maintain the levels of quality and performance which our customers have every right to expect.

A key component of Okonite's operations that contributes to the accomplishment of the above objective is the historical and continuing efforts in the area of Materials Research & Development.

As an extension of our laboratory, Okonite participates as a member of the Institute of Materials Science at the University of Connecticut. This association provides access to the complete breadth of the University facilities with state of the art instruments, techniques and disciplines. As an extension of the IMS, Okonite sponsors experimental work in the Electrical Insulation Research Center (EIRC) to study electrical phenomenon and characteristics. In addition, Okonite is a member of the EPR Consortium which represents manufacturers and suppliers promoting the technical advantages and applications of EPR cables.

RESEARCH

& development

Since its inception, Okonite has had Materials Laboratories dedicated to the investigation of the properties of materials related to their performance in wire and cable. Formulation and compounding research utilizing these materials in insulations and jackets and other cable components have always been a hallmark of Okonite.

It is the responsibility of the Materials Research and Development Department to examine all raw materials going into Okonite compounds and set up formal Technical Requirements, for each of the materials, to which vendors must adhere. All compound formulations are covered by a formal technical requirement which describes in precise detail the characteristics of the compound.

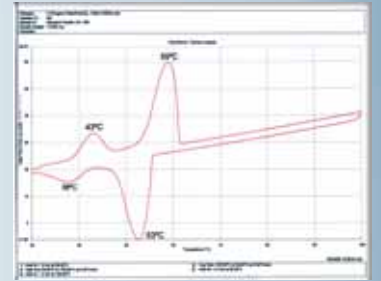
In addition, all purchased components, such as pvc's polyethylenes, fillers, metals, etc. that are to be used in a final cable product, have formal technical requirements associated with them. The technical requirements are controlled documents included in Okonite's QA program which is in accord with NRC 10CFR-50 App B, and ANSI 45.2, and ISO 9002. The technical requirements include acceptance/rejection values of physical, chemical, processability and electrical properties of the various materials and articles as applicable to their intended use in Okonite products.

Material

The laboratory is equipped with the most up-to-date testing equipment. Thermal analysis equipment configured for Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA) and Thermomechanical Analysis (TMA) is in place.

FTIR (Fourier Transform InfraRed) Spectrophotometry instrumentation for analysis and identification of materials is equipped with a computerized library of spectra to which we continuously add information on all materials analyzed by Okonite. In addition, outside analytical service laboratories are used for X-ray diffraction analysis, atomic absorption spectroscopy and mass spectroscopy.

Oscillating Disc Rheometers (ODR's) that not only measure the vulcanization behavior of compounds, but can also provide basic properties of the materials such as the elastic, storage and loss moduli, have been in use for years.



RESEARCH

& testing



Material



A highly instrumented capillary rheometer and laboratory extruder are used in the laboratory for evaluating the extrusion characteristics of compounds. Output, smoothness (melt fracture characteristics) and power consumption vs. variables such as screw design, die design, temperature profile and screw rpm are measured.

These data are used for scaling purposes and guidance for initial plant trials. In addition, excellent predictions as to comparative plant extrusion behavior of several candidate materials can be made quickly in the laboratory.

The combustion characteristics of materials and compounds have become increasingly important in recent times. Concerns as to flame propagation, smoke generation and toxicity of the combustion products are critical to users of wire and cable in, for example, the mass transit industry.

RESEARCH

& testing



Material

The behavior of materials to various environmental factors that can occur in service are regularly determined. These include effects of temperature (accelerated thermal aging), and outdoor exposure (sunlight, fog, rain). In addition, the laboratory is equipped to measure the low temperature properties of materials such as cold bend resistance and brittle point.

The propagation of flame is measured in full scale IEEE 383, NELPIA corner test, or other cable flame test configurations. Capability for flame testing at various heat fluxes up to 400,000 Btu/hr in the various configurations is available.



RESEARCH

environmental behavior



Material



The laboratory has a small scale pilot plant for mixing of formulations into insulation and jacket compounds. The equipment is essentially a small version of our plant mixing equipment. In addition, there is a small tandem CV (Continuous Vulcanization) extrusion line in the laboratory that is used for preparation of wire for electrical evaluation — both long and short term.

Additionally, the testing of physical characteristics of these compounds is performed on state-of-the-art equipment utilizing the latest computerized instrumentation and technology. The physical characteristics can be evaluated at ambient as well as elevated and sub-zero temperatures.

The laboratories are also equipped for testing and evaluation of metals, metal coatings and adhesives.

Paper insulation and paper/polypropylene/paper laminate insulation and the oils associated with them in PILC and pipe type cables are evaluated in terms of friction characteristics, air porosity and physical and chemical properties. The electrical laboratories are set up for electrical measurements on the laminar insulations as well as the impregnating oils used with them.

RESEARCH

laboratory testing



Material

Properties such as % power factor, dielectric constant and strength are routinely determined not only on existing raw materials, but on new candidate materials as well. Typical activity, in both the materials and electrical labs, involved development, evaluation and testing of new improved sources of paper/polypropylene laminate.

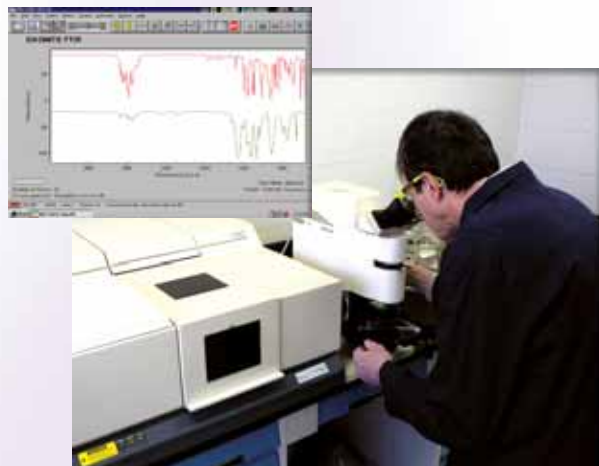
After formulations have been evaluated physically and in terms of processability, the small wire mentioned above is tested in our electrical laboratories. Long term tests at 75° and 90° are underway in our laboratories. The small insulated wires made in the laboratory CV are immersed in water at the desired temperature and energized at 600V ac and/or dc. The electrical properties, such as SIC, power factor and IR are measured at predetermined intervals. Samples of current commercial insulations have been in test for many years under the very highly accelerated conditions mentioned above.

As these tests progress, selection of the best candidate is made and full scale factory trials are run. 5, 15 and 35 kV cables are made and then tested in our high voltage laboratories. A description of the H.V. Labs appears in our brochure "Cable Evaluation and Test Facility."



RESEARCH

laboratory testing



Product Policy



There are, on a continuous basis, on-going research and development programs in the Materials and Electrical Laboratories aimed at the development of new products and/or the use of new materials in existing products. This work is coordinated with the Manufacturing Division to provide full scale cables for evaluation and to determine the feasibility of production.

After the Materials Laboratory, Electrical Laboratory and Manufacturing Division have finished their development and evaluation work, and before a new product or material is introduced and offered to customers, a final review of all pertinent information is made by the Product Policy Committee of The Okonite Company.

COMMITTEE

some final words

Throughout Okonite's distinguished history, the Materials Research and Development Laboratories have played a key role toward the production of the highest quality EPR power and control cables in the industry.

Our legacy of rubber compounders and chemists, from the first moisture resistant Okonite insulation for telegraph to the present excellence of Okoguard insulation, provides a level of quality and confidence our customers rely upon and we continue to uphold.

The investment in our laboratories and the latest state-of-the-art machinery in our plants is an unmatched commitment to the industry which will serve us well into our second century of service.



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*Orangeburg, S.C.



*Orangeburg, S.C - Compound Facility



Paterson, N.J.



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*Qualified to provide nuclear Products

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