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A COMPREHENSIVE BIBLIOGRAPHY
OF LITERATURE PUBLISHED BEFORE 1969
PERTAINING TO
DIELECTRIC PROPERTIES OF
 Al_2O_3 , BeO , HfO_2 , MgO , SiO_2 AND ThO_2

October 1969

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DIELECTRIC PROPERTIES OF
 Al_2O_3 , BeO , HfO_2 , MgO , SiO_2 and ThO_2

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INTRODUCTION

This literature survey was performed for the Division of Reactor Development and Technology of the Atomic Energy Commission under the program entitled, "Development of Methods for Improving High Temperature, High Radiation Performance of Reactor Cable Insulation." The program was designed to fulfill the requirements of LMFBR Task 4-6.2 entitled, "Electrical Insulators for Sensors and Cables." The purpose of the program is to determine the electrical conduction mechanisms and related properties of electrical insulators at high temperatures and to determine the effects of radiation on these properties so that cable insulation for in-reactor use can be improved. A comprehensive search, compilation and analysis of available data from publications is to be supplemented by experiments and to be issued in handbook form and periodically updated as more information becomes available.

This bibliography contains all articles found which pertain to the dielectric properties of alumina, beryllia, hafnia, magnesia, silica and thoria. These materials were chosen because they represent the most attractive candidates for high temperature electrical insulation.

The literature survey was conducted in essentially two steps. The first entailed an exhaustive search for all publications relating to the electrical properties of the aforementioned insulators in the following sources:

1. January 1960 through June 1968 of the Bibliography of High Temperature Chemistry and Physics of Materials in the Condensed State (a quarterly publication).
2. 1907 through 1968 of Chemical Abstracts.
3. 1948 through 1968 of Nuclear Science Abstracts.

Key words used in the last two sources, in addition to the insulator itself, e.g. alumina, aluminum oxide, etc., were dielectric constant, dielectric loss, and electrical breakdown among others. The articles which were found in this way were obtained and filed in our "Insulator Library."

The second step in our literature search involved obtaining pertinent articles which were referenced in the articles obtained in the first step. These articles then yielded articles through their reference list and the process was repeated until no more appropriate articles could be found in this manner.

The bibliography in this report applies only to those articles dealing with dielectric phenomena in the above insulators. Most deal with the dielectric constant, loss or breakdown in the "pure" materials; however, articles dealing with solid solutions of one or more of the above metal oxide insulators have been included for completeness.

All references in the bibliography are listed with the following format:

1. Name of Author or Authors.
2. Title of Article.
3. Journal, book or document in which it can be found.
4. The Chemical Abstract (CA) or Nuclear Science Abstract (NSA) number.

The number corresponding to 4 is not always included. The names of some Journals have been abbreviated in the way prescribed in the Appendix. When an article contains an anonymous author or when it is difficult to determine the authors, e.g., some government progress reports, the letter Q is used.

This bibliography will be periodically updated when an adequate number of additional articles have been found. Also, a bibliography containing articles on other pertinent electrical properties of the same metal oxide insulators will be issued soon.

ALUMINA (Al_2O_3)

E.T. Arakawa and M.W. Williams

"OPTICAL PROPERTIES OF ALUMINUM OXIDE IN THE VACUUM ULTRAVIOLET"

J. Phys. Chem. Solids 29, 735-744 (1968).

W. George and P. Popper

"THE DIELECTRIC PROPERTIES OF SOME COMMERCIAL ALUMINA MATERIALS AT 9368 MHz"

Proc. Brit. Cer. Soc. 10, 63-78 (1968).

F. Argall and A.K. Jonscher

"DIELECTRIC PROPERTIES OF THIN FILMS OF ALUMINUM AND SILICON OXIDE"

Thin Solid Films 2, 185-210 (1968).

CA 69:91116f

T. Vodenicharov

"ANOMALOUS TEMPERATURE DEPENDENCE OF THE DIELECTRIC CONSTANT OF ANODIC ALUMINUM OXIDE LAYERS"

Physics Letters A27, 336 (1968).

CA 69:100852x

J. Antula

"TEMPERATURE DEPENDENCE OF DIELECTRIC CONSTANT OF Al_2O_3 "

Physics Letters 25A, 308 (1967).

G.C. Wood and C. Pearson

"DIELECTRIC BREAKDOWN OF ANODIC OXIDE FILMS ON VALVE METALS"

Corrosion Science 7, 119-125 (1967).

T.L. Gregory

"IRRADIATION OF HIGH PURITY ALUMINA"

N68-13368, NASA CR-72334, GEST-2101 (1967).

M.D. Peters

"THE EFFECT OF TEMPERATURE AND PHOTON RADIATION ON THE ELECTRICAL BREAKDOWN OF CERAMIC INSULATORS"

N67-30924, Ph.D. Thesis, Univ. of Arizona, Tucson, Ariz. (1967).

P.P. Budnikov, et al.

"INFLUENCE OF IRRADIATION BY THERMAL NEUTRONS ON CERTAIN ELECTRICAL PROPERTIES OF CERAMICS MADE FROM PURE ALUMINUM OXIDE"

Izv. Akad. Nauk SSSR, Neorgan. Materialy 3, 94-100 (1967).

Bulletin of the Academy of Sciences USSR, Inorganic Materials 3, 76-80 (1967) (English translation)

W.L.V. Price

"THE MEASUREMENT OF THE PRINCIPAL DIELECTRIC CONSTANTS OF SAPPHIRE BY A MECHANICAL ACTION METHOD"

Brit. J. Appl. Phys. 18, 1679-1688 (1967).

M.D. Peters and M.V. Davis

"THE EFFECTS OF TEMPERATURE AND PHOTON RADIATION ON THE ELECTRICAL
BREAKDOWN OF LUCALOX"

Trans. Am. Nucl. Soc. 10, 117-118 (1967).

J. Iglesias, et al.

"SUPPLEMENTARY DIELECTRIC-CONSTANT AND LOSS MEASUREMENTS ON HIGH-
TEMPERATURE MATERIALS"

AD 650 230, NP-16700, 119pp. (1967).

L. Sztankovics

"ELECTRICAL PROPERTIES OF HIGH-PURITY ALUMINUM OXIDE CERAMIC AT HIGH
TEMPERATURE"

Hiradastechnikai Ipari Kutato Intezet Kozlemenyei 7, 57-73 (1967).

(In Hungarian)

CA 70:40354v

V.F. Korzo

"ELECTRICAL STRENGTH OF ALUMINA FILMS"

Fiz. Tverd. Tela 9, 2753-5 (1967). (In Russian)

CA 68:63503r

R.A. Mickelsen

"DIELECTRIC THIN FILMS BY REACTIVE EVAPORATION"

Symp. Hybrid Microelectron, 2nd 1967, 31-8 (1967). (In English)

CA 70:51984b

S. Kose and Y. Hamao

"DIELECTRIC PROPERTIES OF HOT-PRESSED ALUMINA"

Osaka Kogyo Gijutsu Shikenjo Kiho 18(1), 78-86 (1967). (In Japanese)

CA 67:103540p

G. Stephan, et al.

"OPTICAL PROPERTIES OF INSULATORS IN THE EXTREME ULTRAVIOLET"

Journal of the Optical Society of America 57, 486-492 (1967).

G.S. Perry

"A REVIEW OF THE RECENT LITERATURE ON THE DIELECTRIC PROPERTIES AND
SINTERING OF ALUMINA"

Journal of Materials Science 1, 186-198 (1966).

W.C. Keller

"PERMITTIVITY MEASUREMENTS USING SPHERICAL SAMPLE MICROWAVE SCATTERING
TECHNIQUE"

Revue of Scientific Instruments 37, 1211-1213 (1966).

L. Feinstein, et al.

"RESEARCH ON DIELECTRICS FOR MICROWAVE ELECTRON DEVICES"

AD 629942 (1966).

W.M. Jones and R.E. Evans
"ADSORPTION OF CARBON DIOXIDE AT HIGH PRESSURES (1-100 atm) BY ALUMINA,
DETERMINED FROM MEASUREMENT OF DIELECTRIC CONSTANT"
Transactions of the Faraday Society 62, 1596-1607 (1966).

A.F. Bogoyavlenskii and G.M. Stepanova
"EFFECT OF AGING AND THICKNESS OF Al_2O_3 ANODIC FILMS ON SOME OF ITS
ELECTRICAL PROPERTIES. I. BREAKDOWN VOLTAGE, ELECTRICAL RESISTIVITY,
AND EFFECT OF POLARITY"
Zhurnal Prikladnoi Khimii 39, 2500-5 (1966).
CA 67:32774j

K. Sawamura and M. Saito
"SOME PROPERTIES OF AN ANODIZED Al_2O_3 FILM OF HIGH DIELECTRIC STRENGTH"
Japanese Journal of Applied Physics 5, 182-3 (1966).
CA 64:11990b

L. Sztankovics
"FACTORS INFLUENCING THE FORMATION OF ALUMINUM OXIDE DIELECTRICS
PRODUCED BY ANODIZATION"
Hiradastechnikai Ipari Kutato Intezet Kozlemenyei 6, 23-32 (1966).
CA 68:117879e

I.I. Eru
"DIELECTRIC PROPERTIES OF CERTAIN CRYSTALS AT MILLIMETER WAVELENGTHS"
Zhur. Tekhn. Fiz. 36, 1315-16 (1966).
Sov. Phys.-Tech. Phys. 11, 979-980 (1967) (English translation)

R.E. Kueser, et al.
"DEVELOPMENT AND EVALUATION OF MAGNETIC AND ELECTRICAL MATERIALS
CAPABLE OF OPERATING IN THE 800° TO 1600°F TEMPERATURE RANGE
NASA-CR-54356
or N66-32924 (1965).

D. Edelson, et al.
"TRANSIENT EFFECT OF NUCLEAR RADIATION ON THE DIELECTRIC PROPERTIES OF
CERAMICS AND PLASTICS AT MICROWAVE FREQUENCIES"
National Academy of Sciences, National Research Council Publication,
No. 1356, 16-19 (1965).

I.S. Kainarskii, et al.
"EFFECT OF MODIFYING AGENTS ON THE DIELECTRIC PROPERTIES OF CORUNDUM
CERAMICS"
Izv. Akad. Nauk SSSR, Neorg. Mater 1, 810-15 (1965).
Bulletin of the Academy of Sciences, USSR, Inorganic Materials 1,
742-47 (1965) (English translation)

- E.V. Degtyareva, et al.
 "DIELECTRIC PROPERTIES OF CORUNDUM CERAMICS AND THEIR MICROSTRUCTURE"
 Izv. Akad. Nauk SSSR, Neorgan. Materialy 1, 816-22 (1965).
 Bulletin of the Academy of Sciences USSR, Inorganic Materials 1,
 748-54 (1965) (English translation)
- G.S. Snow
 "DIELECTRIC LOSS IN MgO AND SAPPHIRE"
 Ph.D. Thesis, Univ. of Utah (1965).
- N.M. Tallan and H.C. Graham
 "INTERFACIAL POLARIZATION AND ELECTRICAL CONDUCTIVITY IN SAPPHIRE"
 J. Am. Cer. Soc. 48, 512-16 (1965).
- G.M. Brydon and D.J. Hepplestone
 "MICROWAVE MEASUREMENT OF PERMITTIVITY AND TAN δ OVER THE TEMPERATURE
 RANGE 20-700°C"
 Proceedings of the Institute of Electrical Engineers (London) 112,
 421-25 (1965).
- J.R. Floyd
 "EFFECTS OF FIRING ON THE PROPERTIES OF DENSE HIGH-ALUMINA BODIES"
 Trans. Brit. Cer. Soc. 64, 251-65 (1965).
- W.D. Kingery
 "PROPERTIES OF CERAMICS--DIELECTRIC AND MAGNETIC PROPERTIES"
 pp. 686-761, Introduction to Ceramics, W.D. Kingery (Author), John Wiley
 and Sons, Inc. (1965).
- G.C. Wood and C. Pearson
 "AC RESISTIVITY OF ANODIC OXIDE FILMS ON VALVE METALS"
 Nature 208, 547-9 (1965).
 CA 64:2828c
- M.D. Mashkovich and N.G. Udovenko
 "DIELECTRIC PROPERTIES OF GLASSES OF $\text{MeO-Al}_2\text{O}_3\text{-SiO}_2$ SYSTEM"
 Fiz. Tverd. Tela 7, 524-9 (1965). (In Russian)
 CA 62:12867h
- R.H. Insley and V.J. Barczak
 "THERMAL CONDITIONING OF POLYCRYSTALLINE ALUMINA CERAMICS"
 J. of Am. Cer. Soc. 47, 1-4 (1964).
- J.R. Floyd
 "EFFECT OF SECONDARY CRYSTALLINE PHASES ON DIELECTRIC LOSSES IN HIGH-
 ALUMINA BODIES"
 J. Am. Cer. Soc. 47, 539-543 (1964).

M.D. Mashkovich, et al.

"CAVITY RESONATOR FOR A WAVELENGTH OF 8 mm FOR THE MEASUREMENT OF DIELECTRIC PROPERTIES AT HIGHER TEMPERATURES"

Pribory i Tekhnika Eksperimenta No. 4, 176-179 (1964).

Instruments and Experimental Techniques 4, 894-897 (1964) (English Trans.)

J.B. MacChesney and G.E. Johnson

"ROOM-TEMPERATURE DIELECTRIC PROPERTIES OF FAST-NEUTRON-IRRADIATED FUSED SILICA AND α -ALUMINA"

J. Appl. Phys. 35, 2784-5 (1964).

J.T. Milek

"ALUMINUM OXIDE: DATA SHEETS"

N64-18384, AD 434173 188pp. (1964).

I.S. Kainarskii, et al.

"INTERRELATION BETWEEN THE ELECTRICAL AND MECHANICAL STRENGTHS OF CORUNDUM CERAMICS"

Dokl. Akad. Nauk SSSR 157, 168-70 (1964). (In Russian)

CA 61:15808g

B. Lewis

"DEPOSITION OF Al_2O_3 , SiO_2 , AND MgO LAYERS BY ELECTRON BOMBARDMENT VAPORIZATION"

Microelectron Reliability 3, 109-20 (1964).

CA 65:8153b

F. Oehme

"THE DIELECTRIC PROPERTIES OF CHROMATOGRAPHIC ADSORBENTS"

Chemiker Zeitung. Chemische Apparatur. Mit dem Beiblatt "Chemie-Boerse" 88, 657-661 (1964).

CA 61:15459f

M. Foldvari - Vogl.

"DIELECTRIC PROPERTIES OF MINERALS"

Magyar Allami Foldtani Intezet Evi Jelentese 1961, 103-11 (1964).

(In Hungarian)

CA 65:19413f

W.B. Westphal

TECHNICAL REPORT NUMBER 182

Laboratory for Insulation Research, MIT, Cambridge, Mass. (1963).

W.B. Westphal

"DIELECTRIC CONSTANT AND LOSS MEASUREMENTS ON HIGH TEMPERATURE MATERIALS"

NP-13431 (1963).

E.G. Linden and P. Lascaro

"NEUTRON AND GAMMA RADIATION EFFECTS ON DIELECTRICS"

USAEL-RDL-TR-2323 (1963).

N.M. Tallan and D.P. Detwiler
"AN ANOMALOUS DISSIPATION FACTOR MAXIMUM IN SAPPHIRE"
J. Appl. Phys. 34, 1650-1656 (1963).

F.F. Singer and S.S. Singer
"CERAMICS IN THE ELECTRICAL INDUSTRY"
pps. 1170-1212 of Industrial Ceramics, F. Singer and S.S. Singer (Eds.),
Chapman and Hall, LTD. (London) (1963).

M.D. Mashkovich
"DIELECTRIC LOSSES AND CONSTANT OF $\text{MgO}:\text{Al}_2\text{O}_3\text{-SiO}_2$ COMPOUNDS"
Fiz. Tverd. Tela. 5, 843-50 (1963). (In Russian)
CA 59:1169f

E.J. Smoke, et al.
"STUDY OF HIGH TEMPERATURE MATERIALS"
AD287500, RADC-TDR-62-307 (1962).

L.M. Atlas, et al.
"CONTROL OF DIELECTRIC CONSTANT AND LOSS IN ALUMINA CERAMICS"
J. Am. Cer. Soc. 45 (10), 464-71 (1962).

Q
"REACTOR INSTRUMENTATION AND CONTROL PROGRESS REPORT NO. 72"
GEMP-72 (1962).

C. Feldman and M. Hacskaylo
"TEMPERATURE CHARACTERISTICS OF VACUUM-DEPOSITED DIELECTRIC FILMS"
Rev. Sci. Instr. 33, 1459-60 (1962).
CA 58:9710b

E.M. DaSilva and P. White
"ELECTRICAL PROPERTIES OF EVAPORATED ALUMINUM OXIDE FILMS"
J. Electrochem. Soc. 109, 12-15 (1962).
CA 56:8128g

S. Kato, et al.
"ALUMINA PORCELAIN AS A HIGH-FREQUENCY INSULATOR II. EFFECTS OF
METAL OXIDES"
Nagoya Kogyo Gijutsu Shikensho Hokoku 11, 490-8 (1962). (In Japanese)
CA 57:12120b

M.B. Smyth
"DEVELOPMENT OF ULTRA-LOW-LOSS CERAMIC DIELECTRICS"
Ph.D. Thesis, Rutgers Univ. (1962).

A.R. von Hippel, et al.
 "PROGRESS REPORT NO. XXX LABORATORY FOR INSULATION RESEARCH
 MASSACHUSETTS INSTITUTE OF TECHNOLOGY"
 NP-11584 (1962).

L.J. Frisco
 "DIELECTRICS FOR SATELLITES AND SPACE VEHICLES"
 AD256900 (1961).

Q
 "FOR ELECTRONIC AND NEW CERAMICS"
 Ceramic Industry 76 (1), 84-98 (1961).

J. Pappis and W.D. Kingery
 "ELECTRICAL PROPERTIES OF SINGLE-CRYSTAL AND POLYCRYSTALLINE ALUMINA
 AT HIGH TEMPERATURES"
 J. Am. Cer. Soc. 44, 459-64 (1961).

E. Ryshkewitch
OXIDE CERAMIC
 Academic Press, N.Y. (1960).

J.V. Florio
 "DIELECTRIC PROPERTIES OF ALUMINA AT HIGH TEMPERATURES"
 J. Am. Cer. Soc. 43, 262-267 (1960).

J.W. Newsome, et al.
 "ALUMINA PROPERTIES"
 Aluminum Company of America, Technical Paper No. 10, Pittsburgh,
 Pa. (1960).

L.M. Atlas
 "RESEARCH AND DEVELOPMENT SERVICES LEADING TO THE CONTROL OF
 ELECTRICAL RESEARCH AND DEVELOPMENT PROPERTIES OF MATERIALS FOR
 HIGH TEMPERATURE RADOMES"
 PB1423, WADC-TR-59-300 (1959).

P. Gibbs
 "IMPERFECTION INTERACTIONS IN Al_2O_3 "
 pp. 21-30 of Kinetics of High-Temperature Processes, W.D. Kingery (Ed.),
 John Wiley and Sons, Inc. (London) (1959).

B.R. Eichbaum
 "THE DIELECTRIC BEHAVIOR OF SOLIDS EMBEDDED IN A HOMOGENEOUS MEDIUM"
 J. Electrochem. Soc. 106, 804-809 (1959).

A. von Hippel and W.B. Westphal
 "HIGH-DIELECTRIC-CONSTANT MATERIALS AS CAPACITOR DIELECTRICS: A STUDY
 IN DIELECTRIC SPECTROACOPIY"
 AECU-4558 (1959).

P. Tierney, et al.

"PREPARATION OF SINTERED ALUMINA AND BORON NITRIDE WITH LOW LOSS HIGH TEMPERATURE DIELECTRIC PROPERTIES"

National Academy of Sciences, National Research Council Publications No. 756, 57-60 (1959).

G. Economos

"EFFECT OF MICROSTRUCTURE ON THE ELECTRICAL AND MAGNETIC PROPERTIES OF CERAMICS"

pp. 201-213 of Ceramic Fabrication Processes, W.D. Kingery (Ed.), Tech. Press of MIT and John Wiley and Sons, Chapman and Hall, LTD. (London) (1958).

D.M. Bowie

"MICROWAVE DIELECTRIC PROPERTIES OF SOLIDS FOR APPLICATIONS AT TEMPERATURES TO 3000°F"

IRE Convention Record 5, 270-81 (1957).

P.E. Redmill and P.S. Rogers

"DIELECTRIC MEASUREMENTS IN THE 3 CM WAVELENGTH REGION"

A.E.R.E. GP/R 1479 (1954).

A.H. Scott, et al.

"MEASUREMENT OF DIELECTRIC PROPERTIES AT TEMPERATURES UP TO 500°C"

pp. 3-14 of ASTM Special Technical Publication No. 161, American Society for Testing Materials (1954).

A. von Hippel

"TABLES OF DIELECTRIC MATERIALS"

pp. 291-425 of Dielectric Materials and Applications, A.R. von Hippel (Ed.), John Wiley and Sons, Inc., N.Y., Chapman and Hall, LTD. (London), and Tech. Press of MIT (1954).

J.E. Comeforo and R.A. Hatch

"SYNTHETIC MICA INVESTIGATIONS: IV. DIELECTRIC PROPERTIES OF HOT-PRESSED SYNTHETIC MICA AND OTHER CERAMICS AT TEMPERATURES UP TO 4000°C"

J. Am. Cer. Soc. 37, 317-322 (1954).

N.P. Bogoroditskii and N.L. Polvakova

"DIELECTRIC LOSSES OF ALUMINUM OXIDE"

Dokl. Akad. Nauk SSSR 95, 257-9 (1954). (In Russian)

R.E. Manfredi and H.J. Nolte

"APPLICATIONS OF CERAMICS TO VACUUM TUBES"

Am. Cer. Soc. Bull. 35, 105-107 (1956).

W.L. de Keyser

"A STUDY OF SiO_2 , Al_2O_3 , CaO , AND THEIR COMPOUNDS, IN THE INDUSTRIAL CHEMISTRY LABORATORIES OF THE FREE UNIVERSITY OF BRUSSELS"

Revue Generale des Sciences Appliquees (Brussels) 1, No. 3, 84-108 (1952).
CA 46:10996

H. Miyazawa and J. Okada

"ON THE BREAKDOWN OF ALUMINA AT HIGHER TEMPERATURE"

J. Phys. Soc. Japan 6, 55-9 (1951).

W.C.V. Geel

"CAPACITY AND DIELECTRIC LOSSES OF AN OXIDE LAYER DEPOSITED BY ANODIC OXIDATION ON ALUMINUM"

Philips Research Reports 6, 54-74 (1951). (In French)

D.N. Rao

"DIELECTRIC CONSTANTS AND ELASTIC MODULI OF UNIAXIAL CRYSTALS"

Current Science (India) 19, 116 (1950).

T. Arizumi and S. Tani

"ON THE ELECTRICAL CONDUCTIVITY OF ALUMINA"

J. Phys. Soc. Japan 5, 442-7 (1950).

P.D. Lomer

"THE DIELECTRIC STRENGTH OF ALUMINUM OXIDE FILMS"

Proc. Phys. Soc. B63, 818-820 (1950).

I. Ueda and T. Okada

"ELECTRIC BREAKDOWN OF ALUMINA"

Proceedings of the Physical Society of Japan 4, 8-9 (1949). (In Japanese)

CA 44:10405a

R.F. Geller, et al.

"STUDIES OF BINARY AND TERNARY COMBINATIONS OF MAGNESIA, CALCIA, BARIA, BERYLLIA ALUMINA, THORIA AND ZIRCONIA IN RELATION TO THEIR USE AS PORCELAINS"

J. Res. Natl. Bur. Stand. 36, 277-312 (1946).

O. Glemser

"THE DIELECTRIC CONSTANTS OF SOME OXIDES, HYDROXIDES AND HYDRATED OXIDES"

Z. Elektrochem 45, 865-70 (1939).

A. Gunthershulze and F. Keller

"THE DIELECTRIC CONSTANT OF SOME OXIDES"

Zeitschrift fur Physik 75, 78-83 (1932). (In German)

CA 26:3967⁹

R. Fellingner

"THE DIELECTRIC CONSTANTS OF CERTAIN NATURAL AND SYNTHETIC PRECIOUS STONES AND OF AMBER"

Annales der Physik. 60, 181-95 (1919).

CA 14:1096

BERYLLIA (BeO)

J. Iglesias, et al.

"SUPPLEMENTARY DIELECTRIC-CONSTANT AND LOSS MEASUREMENTS ON HIGH-TEMPERATURE MATERIALS"

AD 650 230, NP-16700, 119pp (1967).

J.F. Bregar

"THE ELECTRICAL PROPERTIES OF CERAMIC INSULATORS AT HIGH TEMPERATURES. ."
Ph.D. Thesis, Univ. of Arizona, Tucson, Ariz. (1966).

G.M. Brydon and D.J. Hepplestone

"MICROWAVE MEASUREMENT OF PERMITTIVITY AND TAN δ OVER THE TEMPERATURE RANGE 20-700°C"

Proceedings of the Institute of Electrical Engineers (London) 112,
421-25 (1965).

D. Edelson, et al.

"TRANSIENT EFFECT OF NUCLEAR RADIATION ON THE DIELECTRIC PROPERTIES OF CERAMICS AND PLASTICS AT MICROWAVE FREQUENCIES"

National Academy of Sciences, National Research Council Publication,
No. 1356, 16-19 (1965).

Q

SUMMARY TECH. REPT. NO. 1

Laboratory for Insulation Research, MIT, Cambridge, Mass.
AFML-TR-65-396 (1965).

S.B. Austerman, et al.

"POLAR PROPERTIES OF BeO SINGLE CRYSTALS"

J. Appl. Phys. 34, 339-341 (1963).

W.B. Westphal

"DIELECTRIC CONSTANT AND LOSS MEASUREMENTS ON HIGH TEMPERATURE MATERIALS"
NP-13431 (1963).

Q

"REACTOR INSTRUMENTATION AND CONTROL PROGRESS REPORT NO. 72"
GEMP-72 (1962).

R.A. Belyaev

"BERYLLIUM OXIDE-PROPERTIES AND APPLICATIONS"

AEC-tr-6175, TID-4500 (34th Ed.) (1962).

E. Ryshkewitch

OXIDE CERAMIC

Academic Press, N.Y. (1960).

A.A. Vorobev and A.P. Nakhodova

"DIELECTRIC LOSSES IN OXIDES AND HALIDE COMPOUNDS OF GROUP II ELEMENTS"

Izvestiya Tomskogo Politekhnicheskogo Instituta imeni S.M. Kirova 95,
306-13 (1958).

U.S. Govt. transl. ORNL-TR-491 (In English)

CA 55:26593h

A.P. Nakhodnova

"RELATIONSHIP BETWEEN THE ELECTRICAL PROPERTIES OF IONIC COMPOUNDS OF GROUP II ELEMENTS AND THE ENERGY OF INTERACTION IONS IN A CRYSTALLINE LATTICE"

Izvestiya Tomskogo Politekhnikheskogo Instituta imenii S.M. Kirova 91, 209-18 (1956).

U.S. Govt. transl. ORNL-490 (In English)

A. von Hippel

"TABLES OF DIELECTRIC MATERIALS"

pp. 291-425 of Dielectric Materials and Applications, A.R. von Hippel (Ed.), John Wiley and Sons, Inc., N.Y., Chapman and Hall, LTD. (London) and Tech. Press of MIT (1954).

S. Nagasawa

"DIELECTRIC PROPERTIES OF RARE-METAL OXIDES"

Denki Kagaku (J. Electrochemical Society of Japan) 18, 158-160 (1950).

U.S. Govt. transl. No. 44704, I-433 (In English)

R.F. Geller, et al.

"STUDIES OF BINARY AND TERNARY COMBINATIONS OF MAGNESIA, CALCIA, BARIA, BERYLLIA, ALUMINA, THORIA AND ZIRCONIA IN RELATION TO THEIR USE AS PORCELAINS"

J. Res. Natl. Bur. Stand. 36, 277-312 (1946).

O. Glemser

"THE DIELECTRIC CONSTANTS OF SOME OXIDES, HYDROXIDES AND HYDRATED OXIDES"

Z. Elektrochem 45, 865-70 (1939).

K. Højendahl

"PROPERTIES OF IONIC CRYSTALS. I. DIELECTRIC CONSTANT OF ALKALINE EARTHS DETERMINED BY AN IMMERSION METHOD DEPENDING ON THE VARIATION WITH TEMPERATURE ON THE DIELECTRIC CONSTANT OF THE IMMERSION LIQUID"

Kongelige Danske Videnskabernes Selskab, Det, Matematisk-Fysiske Meddelelser 16, 1-58 (1938).

CA 32:7320'

HAFNIA (HfO_2)

G.C. Wood and C. Pearson
"DIELECTRIC BREAKDOWN OF ANOCID OXIDE FILMS ON VALVE METALS"
Corrosion Science 7, 119-125 (1967).

Q
SUMMARY TECH. REPT. NO. 1
Laboratory for Insulation Research, MIT, Cambridge, Mass. (1965).
AFML-TR-65-396

F. Huber, et al.
"THIN-FILM Hf-HfO₂ CAPACITORS FOR HIGH-TEMPERATURE OPERATION"
Trans. Int. Vac. Congr., 3rd, Stuttgart, (Pt. 2), 359-61 (1965).
CA 68:25085Y

MAGNESIA (MgO)

- I. Dimitrov
"EFFECT OF THE SYNTHESIS TEMPERATURE ON THE PHYSICAL AND DIELECTRIC INDEXES OF CERAMIC DIELECTRICS FROM THE MAGNESIUM OXIDE-TITANIUM DIOXIDE-CALCIUM DIOXIDE SYSTEM"
Stroitelnye Materialy i Silikatov Promyshlennosti 9, 18-21 (1968).
(In Bulgarian)
CA 69:4871g
- J. Iglesias, et al.
"SUPPLEMENTARY DIELECTRIC-CONSTANT AND LOSS MEASUREMENTS ON HIGH-TEMPERATURE MATERIALS"
AD 650 230, NP-16700, 119pp (1967).
- H. B. Johnson, et al.
"EFFECT OF WATER VAPOR ON DIELECTRIC LOSS IN MgO"
J. Am. Cer. Soc. 49, 390-94 (1966).
- S. Fujii, et al.
"EFFECT OF TITANIA ON SINTERING AND ELECTRICAL CHARACTERISTICS OF ELECTRICAL FUSED MgO"
Himeji Kogyo Daigaku Kenkyu Kokoku 19A, 71-5 (1966). (In Japanese)
CA 67:25031g
- T.J. Gray and D. Guile
"GRAIN BOUNDARY EFFECTS IN RELATION TO THE DIELECTRIC PROPERTIES OF INFRARED TRANSMITTING MATERIALS"
Materials Science Research 3, 149-63 (1966).
- E.K. Beauchamp
"THE EFFECT OF POROSITY AND GRAIN SIZE ON THE PULSE ELECTRICAL STRENGTH OF MgO"
SC-DC-66-1509, CONF-660503-3 (1966).
- H.B. Johnson
"DIELECTRIC LOSS IN POROUS MgO AND CaF₂"
Ph.D. Thesis: Univ. of Utah (1966). ²
- D. Edelson, et al.
"TRANSIENT EFFECT OF NUCLEAR RADIATION ON THE DIELECTRIC PROPERTIES OF CERAMICS AND PLASTICS AT MICROWAVE FREQUENCIES"
National Academy of Sciences, National Research Council Publication, No. 1356, 16-19 (1965).
- G.S. Snow
"DIELECTRIC LOSS IN MgO AND SAPPHIRE"
Ph.D. Thesis: Univ. of Utah (1965).

M.D. Mashkovich and N.G. Udovenko
"DIELECTRIC PROPERTIES OF GLASSES OF $\text{MeO-Al}_2\text{O}_3\text{-SiO}_2$ SYSTEM"
Fiz. Tverd. Tela 7, 524-9 (1965). (In Russian)
Sov. Phys.-Solid State 7, 417-21 (1965) (English translation)
CA 62:12867h

F. Oehme
"THE DIELECTRIC PROPERTIES OF CHROMATOGRAPHIC ADSORBENTS"
Chemiker Zeitung. Chemische Apparatur. Mit dem Beiblatt
"Chemie-Boerse" 88, 657-661 (1964).
CA 61:15459f

B.P. Pradhan and R.C. Gupta
"DIELECTRIC CONSTANT OF MIXTURES"
Dielectrics 1, 195-200 (1964).
CA 60:15254e

B. Lewis
"DEPOSITION OF Al_2O_3 , SiO_2 , AND MgO LAYERS BY ELECTRON BOMBARDMENT
VAPORIZATION"
Microelectron Reliability 3, 109-20 (1964).
CA 65:8153b

F. Singer and S.S. Singer
"CERAMICS IN THE ELECTRICAL INDUSTRY"
pps. 1170-1212 of Industrial Ceramics, F. Singer and S.S. Singer (Eds.),
Chapman and Hall, LTD. (London) (1963).

M. Sugimura, et al.
"SINTERING MIXTURE OF MAGNESIA AND BERYLLIA AS HIGH-FREQUENCY INSULATOR"
Nagoya Kogyo Gijutsu Shikensho Hokoku 12, 187-94 (1963). (In Japanese)
CA 59:1362c

W.B. Westphal
"DIELECTRIC CONSTANT AND LOSS MEASUREMENTS ON HIGH TEMPERATURE MATERIALS"
NP-13431 (1963).

E.G. Linden and P. Lascaro
"NEUTRON AND GAMMA RADIATION EFFECTS ON DIELECTRICS"
USAEL-RDL-TR-2323 (1963).

M.D. Mashkovich
"DIELECTRIC LOSS AND DIELECTRIC CONSTANT OF SITALS OF THE CORDIERITE
SYSTEM"
Fiz. Tverd. Tela. 5, 843-50 (1963).
Sov. Phys.-Solid State 5, 617-22 (1963). (English translation)

A.J. Bosman and E.E. Havinga
"TEMPERATURE DEPENDENCE OF DIELECTRIC CONSTANTS OF CUBIC IONIC
COMPOUNDS"
Phys. Rev. 129, 1593-1600 (1963).

W.B. Westphal
TECHNICAL REPORT NUMBER 182
Laboratory for Insulation Research, MIT, Cambridge, Mass. (1963).

A.R. von Hippel, et al.
"PROGRESS REPORT NO. XXX LABORATORY FOR INSULATION RESEARCH
MASSACHUSETTS INSTITUTE OF TECHNOLOGY"
NP-11584 (1962).

E.J. Smoke, et al.
"STUDY OF HIGH TEMPERATURE MATERIALS"
AD287500, RADC-TDR-62-307 (1962).

B.P. Pradhan and M.N. Sharma
"DIELECTRIC PROPERTIES OF MIXTURES AT RADIO FREQUENCIES"
Proceedings of the National Institute of Sciences of India 26A,
560-8 (1960).
CA 55:11977g

A.A. Vorbev and A.P. Nakhodnova
"DIELECTRIC LOSSES AT HIGH FREQUENCY AND LATTICE ENERGY OF COMPOUNDS
OF METALS OF THE SECOND GROUP"
Zhur. Tekhn. Fiz., Akad. Nauk. SSSR 28 (10), 2173-74 (1958).
Sov. Phys.-Tech. Phys. 3, 2000-2001 (1958) (In Russian)

A.A. Vorobev and A.P. Nakhodova
"DIELECTRIC LOSSES IN OXIDES AND HALIDE COMPOUNDS OF GROUP II ELEMENTS"
Izvestiya Tomskogo Politekhnikheskogo Instituta imeni S.M. Kirova 95,
306-13 (1958).
U.S. Govt. transl. ORNL-TR-491 (In English)
CA 55:26593h

R.S. Smith
"EFFECTIVE DIELECTRIC CONSTANT OF HETEROGENEOUS MEDIA"
J. Appl. Phys. 27, 824-831 (1956).

A.P. Nakhodnova
"RELATIONSHIP BETWEEN THE ELECTRICAL PROPERTIES OF IONIC COMPOUNDS OF
GROUP II ELEMENTS AND THE ENERGY OF INTERACTION IONS IN A CRYSTALLINE
LATTICE"
Izvestiya Tomskogo Instituta imenii S.M. Kirova 91, 209-18 (1956).
U.S. Govt. transl. ORNL-490 (In English)

P.T. Narasimhan
"TEMPERATURE DEPENDENCE OF THE DIELECTRIC CONSTANT OF IONIC CRYSTALS"
Proceedings of the National Institute of Sciences of India 21A,
133-43 (1955).
CA 50:6856g

A. von Hippel

"TABLES OF DIELECTRIC MATERIALS"

pp. 291-425 of Dielectric Materials and Applications, A.R. von Hippel (Ed.), John Wiley and Sons, Inc., N.Y., Chapman and Hall, LTD. (London), and Tech. Press of MIT (1954).

D.N. Rao

"VARIATION OF DIELECTRIC CONSTANTS OF IONIC CRYSTALS WITH PRESSURE"

Phys. Rev. 82, 118-119 (1951).

S. Mayburg

"EFFECT OF PRESSURE ON THE LOW FREQUENCY DIELECTRIC CONSTANT OF IONIC CRYSTALS"

Phys. Rev. 79, 375-382 (1950).

R.F. Geller, et al.

"STUDIES OF BINARY AND TERNARY COMBINATIONS OF MAGNESIA, CALCIA, BARIA, BERYLLIA ALUMINA, THORIA AND ZIRCONIA IN RELATION TO THEIR USE AS PORCELAINS"

J. Res. Natl. Bur. Stand. 36, 277-312 (1946).

K. Højendahl

"PROPERTIES OF IONIC CRYSTALS. I. DIELECTRIC CONSTANT OF ALKALINE EARTHS DETERMINED BY AN IMMERSION METHOD DEPENDING ON THE VARIATION WITH TEMPERATURE ON THE DIELECTRIC CONSTANT OF THE IMMERSION LIQUID"

Kongelige Danske Videnskabernes Selskab, Det, Matematisk-Fysiske Meddelelser 16, 1-58 (1938)

CA 32:7320'

O. Glemser

"THE DIELECTRIC CONSTANTS OF SOME OXIDES, HYDROXIDES AND HYDRATED OXIDES"

Z. Elektrochem 45, 865-70 (1939).

SILICA (SiO_2)

F.L. Worthing

"DIRECT-CURRENT DIELECTRIC BREAKDOWN OF AMORPHOUS SILICON DIOXIDE FILMS AT ROOM TEMPERATURE"

J. Electrochem. Soc. 115, 88-92 (1968).

CA 68:34130m

I.H. Pratt

"PROCESSING AND EVALUATION OF Rf SPUTTERED QUARTZ"

Transactions of the Metallurgical Society of AIME 242, 526-531 (1968).

A.S. Nowick

"DEFECTS IN CRYSTALS"

CU-3712-05 (1968).

A.G. Cockbain

"HIGH-QUALITY CERAMIC DIELECTRICS SINTERED IN REDUCING ATMOSPHERES"

Proc. of the Brit. Cer. Soc. 10, 225-237 (1968).

F. Argall and A.K. Jonscher

"DIELECTRIC PROPERTIES OF THIN FILMS OF ALUMINUM AND SILICON OXIDE"

Thin Solid Films 2, 185-210 (1968).

CA 69:9116f

R.A. Mickelsen

"DIELECTRIC THIN FILMS BY REACTIVE EVAPORATION"

Symp. Hybrid Microelectron, 2nd, 1967, 31-8 (1967). (In English)

CA 70:51984b

S.V. Starodubtsev

"CHANGE IN THE TEMPERATURE FLOW OF THE DIELECTRIC CONSTANT FOR QUARTZ PLATELETS . . . UNDER THE EFFECT OF NEUTRON AND γ -IRRADIATION"

Izv. Akad. Nauk SSSR, Neorgan. Materialy 3, 1704-5 (1967).

CA 68:90845k

G.I. Potakhova

"EFFECT OF IONIZING RADIATION ON THE DIELECTRIC CHARACTERISTICS OF QUARTZ"

Radiats. Fiz. Nometal. Krist., Tr Soveshch., Keiv 1965, 371-75 (1967).

CA 70:41788b

S.W. Bradstreet

"OXIDE CERAMICS"

pp. 235-303 in High Temperature Materials and Technology, I.E. Campbell and E.M. Sherwood (Eds.), John Wiley and Sons, Inc., N.Y. (1967).

J. Iglesias, et al.

"SUPPLEMENTARY DIELECTRIC-CONSTANT AND LOSS MEASUREMENTS ON HIGH-TEMPERATURE MATERIALS"

AD 650 230, NP-16700, 119 pp. (1967).

- M.S. Krivov, et al.
 "RELAXATION PROCESSES IN CRYSTALS UNDER THE EFFECTS OF X-RAYS"
 Mezhvuzovskaya Sbornik Zapiski-Sibirskogo Sov. Koord. Planir. Nauchno-Issledovatel'skie Rab. Tekh. Estestv. Nauck. 1966, No. 5, 16-17 (1966).
 (In Russian)
 CA 69:47052h
- J. Volger
 "DIELECTRIC LOSSES OF SOME GLASSES AND RELATED MATERIALS MEASURED AT LOW TEMPERATURES"
 Industrie Chimique 20, 128-32 (1966).
 CA 51:1561c
- G.I. Potakhova
 "EFFECT OF γ -RADIATION ON THE DIELECTRIC PROPERTIES OF QUARTZ"
 Izv. V.U.Z., Fiz. 9, 110-13 (1966). (In Russian)
 CA 65:19805e
- I.I. Eru
 "DIELECTRIC PROPERTIES OF CERTAIN CRYSTALS AT MILLIMETER WAVELENGTHS"
 Zhur. Tekhn. Fiz. 36, 1315-16 (1966).
 Sov. Phys.-Tech. Phys. 11, 979-980 (1967) (English translation)
- M.D. Mashkovich and E.N. Smelyanskaya
 "ON THE NATURE OF THE DIELECTRIC LOSSES IN GLASSES AT UHF"
 Fiz. Tverd Tela 7, 1008-11 (1965).
 Sov. Phys.-Solid State 7, 811-13 (1965) (English translation)
- M.D. Mashkovich and N.G. Udovenko
 "DIELECTRIC PROPERTIES OF GLASSES OF $\text{MeO-Al}_2\text{O}_3\text{-SiO}_2$ SYSTEM"
 Fiz. Tverd. Tela 7, 524-9 (1965). (In Russian)
 Sov. Phys.-Solid State 7, 417-21 (1965) (English translation)
 CA 62:12867h
- W.D. Kingery
 "PROPERTIES OF CERAMICS--DIELECTRIC AND MAGNETIC PROPERTIES"
 pp. 686-761, Introduction to Ceramics, W.D. Kingery (Author), John Wiley and Sons, Inc. (1965).
- D. Edelson, et al.
 "TRANSIENT EFFECT OF NUCLEAR RADIATION ON THE DIELECTRIC PROPERTIES OF CERAMICS AND PLASTICS AT MICROWAVE FREQUENCIES"
 National Academy of Sciences, National Research Council Publication, Number 1356, 16-19 (1965).
- G.M. Brydon and D.J. Hepplestone
 "MICROWAVE MEASUREMENT OF PERMITTIVITY AND $\tan \delta$ OVER THE TEMPERATURE RANGE 20-700°C"
 Proceedings of the Institute of Electrical Engineers (London) 112, 421-25 (1965).

V.G. Zubov, et al.

"VARIATION IN THE DIELECTRIC CONSTANT OF QUARTZ IN RESPONSE TO A STEADY ELECTRIC FIELD"

Kristallografiya 9 (6), 864-69 (1965).

Soviet Physics-Crystallography 9, 729-732 (1965) (English translation)

B. Lewis

"DEPOSITION OF Al_2O_3 , SiO_2 , AND MgO LAYERS BY ELECTRON BOMBARDMENT VAPORIZATION"

Microelectron. Reliability 3, 109-20 (1964).

CA 65:8153b

B.P. Pradhan and R.C. Gupta

"DIELECTRIC CONSTANT OF MIXTURES"

Dielectrics 1, 195-200 (1964).

CA 60:15254e

M.D. Mashkovich, et al.

"CAVITY RESONATOR FOR A WAVELENGTH OF 8mm FOR THE MEASUREMENT OF DIELECTRIC PROPERTIES AT HIGHER TEMPERATURES"

Pribory i Tekhnika Eksperimenta No. 4, 176-179 (1964).

Instruments and Experimental Techniques 4, 894-897 (1964) (English translation)

J.B. MacChesney and G.E. Johnson

"ROOM-TEMPERATURE DIELECTRIC PROPERTIES OF FAST-NEUTRON-IRRADIATED FUSED SILICA AND α -ALUMINA"

J. Appl. Phys. 35, 2784-5 (1964).

E.H. Snow and P. Gibbs

"DIELECTRIC LOSS DUE TO IMPURITY CATION MIGRATION IN α -QUARTZ"

J. Appl. Phys. 35, 2368-2374 (1964).

E.H. Snow

"DIELECTRIC LOSS DUE TO IMPURITY CATION MIGRATION IN QUARTZ"

Ph.D. Thesis: Univ. of Utah (1963).

R.E. Jaeger and H.T. Smyth

"THE EFFECT OF NEUTRON IRRADIATION ON THE LOW TEMPERATURE DIELECTRIC RELAXATION IN FUSED SILICA"

CONF-478-1, 28pp. from the Am. Ceram. Soc. Glass Div. Mtg., Bedford, Penna (1963).

G.I. Potakhova

"DIELECTRIC LOSSES IN QUARTZ UNDER THE ACTION OF X-IRRADIATION"

Izv. V.U.Z., Fiz. 1963, 71-75 (1963). (In Russian)

CA 60:84a

M.D. Mashkovich
 "DIELECTRIC LOSS AND DIELECTRIC CONSTANT OF SITALS OF THE CORDIERITE SYSTEM"

Fiz. Tverd. Tela. 5, 843-50 (1963).
 Sov. Phys.-Solid State 5, 617-22 (1963) (English translation)
 CA 59:1169f

C. Hirayama and D. Berg
 "DIELECTRIC PROPERTIES OF GLASSES IN THE SYSTEM $\text{Nb}_2\text{O}_5\text{-Na}_2\text{O-SiO}_2$ "
 J. Am. Cer. Soc. 46, 85-88 (1963).

W.B. Westphal
 TECHNICAL REPORT NUMBER 182
 Laboratory for Insulation Research, MIT, Cambridge, Mass. (1963).

C. Demau
 "MEASUREMENTS OF DIELECTRIC CONSTANTS AND DIELECTRIC ANISOTROPIES OF VARIOUS CRYSTALS IN THE X BAND"
 Journal de Physique (Paris) 24, 284-5 (1963) (In French)
 CA 63:5071c

M.D. Mashkovich
 "DIELECTRIC LOSSES OF GLASSES AT THE WAVELENGTH OF 8mm"
 Fiz. Tverd. Tela 5, 1740-42 (1963).
 Sov. Phys.-Solid State 5, 1265-67 (1963) (English translation)

J.M. Stevels
 "THE DIELECTRIC PROPERTIES OF QUARTZ CRYSTALS AND FUSED SILICA IN RELATION TO THEIR IMPERFECTIONS"
 pp. 368-393 of Proceedings of the International School of Physics, "Enrico Fermi"
 Course XXVII; D. Selle (Ed.) (1963).

V.G. Zubov, et al.
 "VARIATION OF DIELECTRIC CONSTANTS OF CRYSTALLINE AND FUSED QUARTS WITH TEMPERATURE"
 Kristallografiya 8 (1), 112-13 (1963)
 Soviet Physics-Crystallography 8, 85-86 (1963) (English translation)

W.B. Westphal
 "DIELECTRIC CONSTANT AND LOSS MEASUREMENTS ON HIGH TEMPERATURE MATERIALS"
 NP-13431 (1963).

E.G. Linden and P. Lascaro
 "NEUTRON AND GAMMA RADIATION EFFECTS ON DIELECTRICS"
 USAEL-RDL-TR-2323 (1963).

V.G. Zubov and A.P. Grishina
 "DIELECTRIC CONSTANT AND REFRACTIVE INDICES OF QUARTZ AFTER EXPOSURE TO FAST NEUTRONS"
 Kristallografiya 7 (2), 238-41 (1962).
 Soviet Physics-Crystallography 7, 185-187 (1962) (English translation)

- M.B. Smyth
 "DEVELOPMENT OF ULTRA-LOW-LOSS CERAMIC DIELECTRICS"
 Ph.D. Thesis: Rutgers Univ. (1962).
- J.M. Stevels, et al.
 "DIELECTRIC LOSSES IN QUARTZ CRYSTALS IN RELATION TO THEIR IMPERFECTIONS"
 Philips Research Reports 17, 283-314 (1962).
- E.J. Smoke, et al.
 "STUDY OF HIGH TEMPERATURE MATERIALS"
 AD287500, RADC-TDR-62-307 (1962).
- C. Feldman and M. Hacskaylo
 "TEMPERATURE CHARACTERISTICS OF VACUUM-DEPOSITED DIELECTRIC FILMS"
 Rev. Sci. Instr. 33, 1459-60 (1962).
 CA 58:9710b
- R.A. Padmanahan
 "DETERMINATION OF DIELECTRIC CONSTANTS OF SINGLE CRYSTALS AT VERY
 HIGH FREQUENCIES"
 Journal of Scientific and Industrial Research (India) 20B, 303-6 (1961).
 CA 56:5485d
- R. Kiriya
 EFFECT OF γ -IRRADIATION ON QUARTZ AND SOME SILICATE MATERIALS"
 Proceedings of the Japanese Conference on Radioisotopes 4th, 286-91
 (1961) (In Japanese)
- J.A. Ellis
 "PHENOMENA RELATED TO THE ANOMALOUS DIELECTRIC CONSTANT OF QUARTZ"
 Ph.D. Thesis: State Univ. of Iowa (1961).
- M.D. Mashkovich
 "DIELECTRIC LOSS AND PERMEABILITY OF GLASS AT VERY HIGH FREQUENCIES"
 Fiz. Tverd. Tela. 3, 1105-9 (1961).
 Sov. Phys.-Solid State 3, 804-6 (1961) (English translation)
- L.J. Frisco
 "DIELECTRICS FOR SATELLITES AND SPACE VEHICLES"
 AD256900 (1961).
- R. Kiriya and S. Kawai
 "DIELECTRIC PHENOMENA IN SMOKY QUARTZ, NATURAL QUARTZ AND γ AND
 γ -IRRADIATED"
 Mineralogical Journal (Tokyo) 3, 19-29 (1960).
- D.A. Dimitrochenko and V.A. Shevelev
 "USE OF COAXIAL RESONATORS FOR MEASURING DIELECTRIC LOSSES AND
 DIELECTRIC CONSTANT OF POLYMERS IN RELATION TO TEMPERATURE"
 Fizika Dielektrikov (Moscow: Akademiya Nauk SSSR) Sbornik 1960,
 132-8 (1960). (In Russian)
 CA 56:2979h

B.P. Pradhan and M.N. Sharma
 "DIELECTRIC PROPERTIES OF MIXTURES AT RADIO FREQUENCIES"
 Proceedings of the National Institute of Sciences of India 26A,
 560-8 (1960).
 CA 55:11977g

B.R. Eichbaum
 "THE DIELECTRIC BEHAVIOR OF SOLIDS EMBEDDED IN A HOMOGENEOUS MEDIUM"
 J. Electrochem. Soc. 106, 804-809 (1959).

R. Kiriya
 "DIELECTRIC PHENOMENA OF QUARTZ"
 Kobunshugaku Zasshi 3, 609-25 (1958).
 CA 57:9322e

J. Volger and J.M. Stevels
 "EXPERIMENTAL INVESTIGATION OF DIELECTRIC LOSSES OF SOME GLASSES AT
 LOW TEMPERATURES"
 Verres et Refractaires 11, 137-46 (1957).
 CA 52:2358d

D.M. Bowie
 "MICROWAVE DIELECTRIC PROPERTIES OF SOLIDS FOR APPLICATIONS AT
 TEMPERATURES TO 3000°F"
 IRE Convention Record 5, 270-81 (1957).

J.M. Stevels
 "THE ELECTRICAL PROPERTIES OF GLASS"
 pp. 350-92 of Handbuch der Physik (Encyclopedia of Physics), S. Flugge
 (Ed.), V20, Electrical Conductivity II, Springer-Verlag, Berlin (1957).

H.E. Wenden
 "IONIC DIFFUSION AND THE PROPERTIES OF QUARTZ I. THE DIRECT-CURRENT
 RESISTIVITY"
 American Mineralogist 42, 859-88 (1957).

R.S. Smith
 "EFFECTIVE DIELECTRIC CONSTANT OF HETEROGENEOUS MEDIA"
 J. Appl. Phys. 27, 824-831 (1956).

J. Volger and J.M. Stevels
 "FURTHER EXPERIMENTAL INVESTIGATION OF THE DIELECTRIC LOSSES OF VARIOUS
 GLASSES AT LOW TEMPERATURES"
 Philips Research Report 11, 452-470 (1956).

R.E. Manfredi and H.J. Nolte
 "APPLICATIONS OF CERAMICS TO VACUUM TUBES"
 Am. Cer. Soc. Bull. 35, 105-107 (1956).

J. Volger and J.M. Stevels
 "ELECTRIC POLARIZABILITY OF COLOUR CENTRES IN QUARTZ CRYSTALS AND GLASSES"
 Philips Research Report 11, 79-80 (1956).

J. Volger, et al.
 "DIELECTRIC LOSSES OF VARIOUS MONOCRYSTALS OF QUARTZ AT VERY LOW TEMPS"
 Philips Research Reports 10, 260-80 (1955).

M.R. Stuart
 "DIELECTRIC CONSTANT OF QUARTZ AS A FUNCTION OF FREQUENCY AND
 TEMPERATURE"
 J. Appl. Phys. 26, 1399-1404 (1955).

A. von Hippel
 "TABLES OF DIELECTRIC MATERIALS"
 pp. 291-425 of Dielectric Materials and Applications, A.R. von Hippel
 (Ed.), John Wiley and Sons, Inc., N.Y., Chapman and Hall, LTD.
 (London) and Tech. Press of MIT (1954).

J. Vermeer
 "THE IMPULSE BREAKDOWN STRENGTH OF PYREX GLASS"
 Physica 20, 313-326 (1954).

O.E. Anderson
 "EFFECT OF ELEVATED TEMPERATURE ON SILICONE VARNISHED GLASS FABRIC
 FOR ELECTRICAL INSULATION"
 pp. 121-136 of ASTM Special Technical Publication Number 161, American
 Society for Testing Materials (1954).

W.L. de Keyser
 "A STUDY OF SiO_2 , Al_2O_3 , CaO , AND THEIR COMPOUNDS, IN THE INDUSTRIAL
 CHEMISTRY LABORATORIES OF THE FREE UNIVERSITY OF BRUSSELS"
 Revue Generale des Sciences Appliquees (Brussels) 1, No. 3, 84-108
 (1952).
 CA 46:10996

S. Whitehead
DIELECTRIC BREAKDOWN OF SOLIDS
 Oxford at the Clarendon Press (London) (1951).

P.L. Kirby
 "ELECTRICAL CONDUCTION IN GLASS"
 Brit. J. Appl. Phys. 1, 193-202 (1950).

A.L. Khodakov
 "DIELECTRIC LOSSES IN CERAMIC DIELECTRICS AND IN BARIUM TITANATE AT
 HIGH FREQUENCIES"
 Zhur. Tekhn. Fiz. 20, 529-33 (1950). (In Russian)
 CA 44:8713d

- D.N. Rao
"DIELECTRIC CONSTANTS AND ELASTIC MODULI OF UNIAXIAL CRYSTALS"
Current Science (India) 19, 116 (1950).
CA 44:8181a
- F. Borgnis
"HIGH TEMPERATURE MEASUREMENTS ON DIELECTRIC SUBSTANCES IN THE REGION
OF CENTIMETER WAVES"
Helvetica Physica Acta 22, 149-54 (1949).
CA 43:7204e
- S.K. Jatkari, et al.
"DIELECTRIC CONSTANT OF SILICA"
Indian Journal of Physics 23, 145-52 (1949).
CA 44:4300h
- B.N. Harden
"DIELECTRIC PROPERTIES OF CRYSTAL QUARTZ AT HIGH FREQUENCIES"
Royal Society of New Zealand Transactions 77 (5), 45-50 (1949)
CA 44:6213e
- D.N. Rao
"DIELECTRIC CONSTANTS OF CRYSTALS. I. DIFFERENT TYPES OF QUARTZ"
Proceedings of the Indian Academy of Science 25A, 408-12 (1947).
CA 42:430h
- A. von Hippel and R.J. Maurer
"ELECTRICAL BREAKDOWN OF GLASSES AND CRYSTALS AS A FUNCTION OF
TEMPERATURE"
Phys. Rev. 59, 820-823 (1941).
- J. Takubo
"THE DIELECTRIC CONSTANTS OF SOME MINERALS AND THEIR DIELECTRIC
CONSTANTS WHEN HEATED"
Memoirs of the College of Science, University of Kyoto, Series B,
16, 95-154 (1941). (In German)
CA 45:4177b
- T. Akahira, et al.
"TEMPERATURE CHARACTERISTICS OF DIELECTRIC LOSSES AT HIGH FREQUENCIES"
Bulletin of the Institute of Physical Chemistry (Tokyo) 18, 417-28
(1939).⁸
CA 34:3551⁸
- N.G. Rahimi
"THE ELECTRICAL CONDUCTIVITY AND THE DIELECTRIC CONSTANT OF QUARTZ
AND SOME OTHER CRYSTALS"
Journal de Physique et Le Radium 9, 291-6 (1938).
CA 32:8231⁵

N. Bogoroditskii and I. Fridberg
"DIELECTRIC LOSSES IN INORGANIC GLASSES AT RADIO FREQUENCIES"
Zhur. Tekhn. Fiz. 4, 707-16 (1937). (In Russian)
CA 32:2304⁹

W.A. Yager and S.O. Morgan
"SURFACE LEAKAGE OF PYREX GLASS"
J. Phys. Chem. 35, 2026-2042 (1931).

P.H. Moon and A.S. Norcross
"THREE MECHANISMS OF BREAKDOWN OBTAINED ON GLASS BY ELIMINATION OF
EDGE EFFECT"
Journal of The Franklin Institute 208, 705-729 (1929).

V.E. Whitman
"DATA ON THE FLOW OF ELECTRIC CURRENT IN QUARTZ"
Journal of the Optical Society of America 12, 31-43 (1926).
CA 20:1023⁶

THORIA (ThO₂)

S.W. Bradstreet
"OXIDE CERAMICS"

pp. 235-303 in High Temperature Materials and Technology, I.E. Campbell
and E.M. Sherwood (Eds.), John Wiley and Sons, Inc., N.Y. (1967).

W.B. Westphal
"DIELECTRIC CONSTANT AND LOSS MEASUREMENTS ON HIGH TEMPERATURE MATERIALS"
NP-13431 (1963).

J.B. Wachtman, Jr.
"MECHANICAL AND ELECTRICAL RELAXATION IN ThO₂ CONTAINING CaO"
Phys. Rev. 131, 517-527 (1963).

W.B. Westphal
TECHNICAL REPORT NUMBER 182
Laboratory for Insulation Research, MIT, Cambridge, Mass. (1963).

S. Nagasawa
"DIELECTRIC PROPERTIES OF RARE-METAL OXIDES"
Denki Kagaku (J. Electrochemical Society of Japan) 18, 158-160 (1950).
U.S. Govt. transl. No. 44704, I-433 (In English)

A. Gunthershulze and F. Keller
"THE DIELECTRIC CONSTANT OF SOME OXIDES"
Zeitschrift fur Physik 75, 78-83 (1932). (In German)
CA 26:3967⁹

OTHER SELECTED METAL OXIDE INSULATOR AND GENERAL ARTICLES

W.W. Scott and R.K. MacCrone

"MECHANICAL AND DIELECTRIC RELAXATION OF HOPPING ELECTRONS AND THE IONIC DEFECTS IN REDUCED RUTILE (TiO_{2-x})

pp. 189-195, Mass Transport in Oxides, J.B. Wachtman and A.D. Franklin (Eds.), National Bureau of Standards Special Publication 296 (1968).

J.M. Herbert

"THE AGING WITH A.C., D.C. AND ZERO FIELDS OF A COMPLEX HIGH PERMITTIVITY DIELECTRIC"

Proc. Brit. Cer. Soc. 10, 205-224 (1968).

J. Ranachowski and T. Las

"EFFECT OF STRUCTURE ON ELECTRIC PROPERTIES OF CERAMICS"

Polska Akademia Nauk, Oddzial w Krakowie, Prace Komisji Nauk Technicznych, Ceramika 1968, 10, 5-48 (1968) (In English).

CA 69:109389j

W.C. Keller

"DETERMINING THE DIELECTRIC CONSTANTS APPLICABLE TO HIGH TEMPERATURES" A65-10817, AD 605391, 12pp. (1964).

Q

"ON INSULATION"

NP-12214, Progress Report Number 31; MIT (1962).

B.I. Vorozhtsov, et al.

"DIELECTRIC PROPERTIES OF INSULATORS UNDER γ -IRRADIATION. I. METHOD OF MEASURING DIELECTRIC CHARACTERISTICS DURING IRRADIATION"

Izv. V.U.Z., Fiz. 1962, No. 4, 163-170 (1962).

U.S. Govt. transl. 63-11708 (OTS), NRL transl. No. 940 (In English).

R. Gerson and T.C. Marshall

"DIELECTRIC BREAKDOWN OF POROUS CERAMICS"

J. Appl. Phys. 30, 1650-53 (1959).

H. Frohlich and B.V. Paranjape

"DIELECTRIC BREAKDOWN IN SOLIDS"

Proc. Phys. Soc. (London) B69, 21-32 (1956).

W.F. Brown

"DIELECTRICS"

pp. 1-153 of Handbuch der Physik (Encyclopedia of Physics), S. Flugge (Ed.), V17, "Dielectrics," Springer-Verlog, Berlin (1956).

F.E. Harris and C.T. O'Konski

"MEASUREMENT OF HIGH PERMITTIVITY DIELECTRICS AT MICROWAVE FREQUENCIES"

Rev. Sci. Instr. 26, 482-85 (1955).

C.P. Smyth

DIELECTRIC BEHAVIOR AND STRUCTURE

McGraw-Hill Book Co., Inc., N.Y. (1955).

A. von Hippel

"THEORY (OF DIELECTRIC MATERIALS)"

pp. 3-46 of Dielectric Materials and Applications, A.R. von Hippel (Ed.), John Wiley and Sons, Inc., N.Y., Chapman and Hall, LTD. London and Technical Press of MIT (1954).

R.F. Field and W.B. Westphal

"DIELECTRIC MEASURING TECHNIQUES - PERMITTIVITY"

pp. 47-121 of Dielectric Materials and Applications, A.R. von Hippel (Ed.), John Wiley and Sons, Inc., Chapman and Hall, LTD., London and Tech. Press of MIT (1954).

D.J. Epstein

"DIELECTRIC MEASURING TECHNIQUES - PERMEABILITY"

pp. 122-133 of Dielectric Materials and Applications, A.R. von Hippel (Ed.), John Wiley and Sons, Inc., N.Y., Chapman and Hall, LTD., London and Tech. Press of MIT, (1954).

M.W.P. Strandberg

"DIELECTRIC MEASURING TECHNIQUES - MICROWAVE SPECTROSCOPY"

pp. 134-138 of Dielectric Materials and Applications, A.R. von Hippel (Ed.), John Wiley and Sons, Inc., N.Y., Chapman and Hall, LTD., London and Tech. Press of MIT (1954).

F. Bitter

"DIELECTRIC MEASURING TECHNIQUES - MAGNETIC RESONANCE"

pp. 139-146 of Dielectric Materials and Applications, A.R. von Hippel (Ed.), John Wiley and Sons, Inc., N.Y., Chapman and Hall, LTD., London and Tech. Press of MIT (1954).

J.G. Trump

"DIELECTRIC MATERIALS AND APPLICATIONS (BREAKDOWN)"

pp. 147-56 of Dielectric Materials and Applications, A.R. von Hippel (Ed.), John Wiley and Sons, Inc., Chapman and Hall, LTD., London and Tech. Press of MIT (1954).

H. Thurnauer

"DIELECTRIC MATERIALS AND APPLICATIONS - CERAMICS"

pp. 179-189 of Dielectric Materials and Applications, A.R. von Hippel (Ed.), John Wiley and Sons, Inc., N.Y., Chapman and Hall, LTD., London and Tech. Press of MIT (1954).

S.J. Rosch

"DIELECTRICS IN EQUIPMENT - PROBLEMS OF THE CABLE ENGINEER"

pp. 233-41 of Dielectric Materials and Applications, A.R. von Hippel (Ed.) John Wiley and Sons, Inc., N.Y., Chapman and Hall, LTD. London and Tech. Press of MIT (1954).

A.R. von Hippel

"DIELECTRICS AND WAVES"

John Wiley and Sons, N.Y., Chapman and Hall, LTD., London (1954).

W.F. Ford and J. White
"ELECTRICAL PROPERTIES OF OXIDE MIXTURES"
Trans. Brit. Cer. Soc. 51, 50-79 (1952).

H.B. Callen
"ELECTRIC BREAKDOWN IN IONIC CRYSTALS"
Phys. Rev. 76, 1394-1402 (1949).

H. Frohlich
"ON THE THEORY OF DIELECTRIC BREAKDOWN IN SOLIDS"
Proc. Roy. Soc. (London) A188, 521-32 (1947).

H. Frohlich
"THEORY OF ELECTRICAL BREAKDOWN IN IONIC CRYSTALS"
Proc. Roy. Soc. (London) A172, 94-106 (1939).
CA 33:7631¹

E.J. Murphy and S.C. Morgan
"THE DIELECTRIC PROPERTIES OF INSULATING MATERIALS"
Bell System Technical Journal 17, 640-669 (1938).

E.J. Murphy and S.O. Morgan
"THE DIELECTRIC PROPERTIES OF INSULATING MATERIALS"
Bell System Technical Journal 16, 493-512 (1937).

H. Frohlich
"THEORY OF ELECTRICAL BREAKDOWN IN IONIC CRYSTALS"
Proc. Roy. Soc. (London) 160A, 230-41 (1937).

APPENDIXPeriodical Abbreviations

Trans. Am. Nucl. Soc.

Transactions of the American Nuclear Society

Am. Cer. Soc. Bull.

American Ceramic Society Bulletin

J. Am. Cer. Soc.

Journal of the American Ceramic Society

Appl. Phys. Let.

Applied Physics Letters

Proc. Brit. Cer. Soc.

Proceedings of the British Ceramic Society

Trans. Brit. Cer. Soc.

Transactions of the British Ceramic Society

Brit. J. Appl. Phys.

British Journal of Applied Physics

Dokl. Akad. Nauk SSSR

Doklady Akademii Nauk SSSR

J. Elektrochem. Soc.

Journal of the Electrochemical Society

Fiz. Tverd. Tela

Fizika Tverdogo Tela

Sov. Phys.-Solid State

Soviet Physics-Solid State

Izv. V.U.Z., Fiz.

Izvestiya Vysshikh Uchebnykh
Zavedenii, Fizika

Izv. Akad. Nauk SSSR, Neorgan. Materialy

Izvestiya Akademii Nauk SSSR, Neorganicheskie Materialy

J. Appl. Phys.

Journal of Applied Physics

J. Chem. Phys.

Journal of Chemical Physics

- J. Nucl. Mater.
Journal of Nuclear Materials
- J. Phys. Chem.
Journal of Physical Chemistry
- J. Phys. Chem. Solids
Journal of Physics and Chemistry of Solids
- J. Res. Natl. Bur. Stds.
Journal of Research of the National Bureau of Standards
- Phil. Mag.
Philosophical Magazine
- Phys. Rev.
Physical Review
- Proc. Phys. Soc. (London)
Proceedings of the Physical Society (London)
- J. Phys. Soc. Japan
Journal of the Physical Society of Japan
- Rev. Sci. Instr.
Revue of Scientific Instruments
- Proc. Roy. Soc. (London)
Proceedings of the Royal Society (London)
- Tr. Inst. Elektrokhim., Akad. Nauk SSSR, Ural. Filial
Trudy Instituta Elektrokhimii, Akademiya Nauk SSSR, Uralskii Filial
- Z. Elektrochem.
Zeitschrift fur Elektrochemie
- Zhur. Fiz. Khim.
Zhurnal Fizicheskoi Khimii
- Russ. J. Phys. Chem.
Russian Journal of Physical Chemistry
- Zhur. Tekhn. Fiz.
Zhurnal Tekhnicheskoi Fiziki
- Sov. Phys.-Tech. Phys.
Soviet Physics-Technical Physics

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