International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 3, May-Jun-2019, ISSN (Online): 2395-566X

The Forecast with Nanotechnology in Electrical Power Systems Engineering A Study

Dr. Sardar Ali
Dept. of EEE
Dept. Deccan College of Engg. & Tech.
Darussalam, Nampally, Hyderabad , India
dr.saliswccc@gmail.com

Reshma Sultana Husna
Dept. of EIE
PDA College of Engineering
Kalaburagi, Karnataka, India
husnaasif807@gmail.com

Abstract- **Nanotechnology is the learning of particularly minute constitutions, having size of 0.1 to 100 nm. Nano medication is a comparatively new ground of science and technology. Brief enlightenment of various types of pharmaceutical nano systems is given. Categorization of nano materials based on their aspects is given. An application of Nanotechnology in various grounds such as physical condition and medication, electronics, energy, environment and Electrical Power Systems etc. In this paper Electrical power systems is presented in detail. Nanotechnology is one of the best ever developing grounds in research and technology. The main concentration of nanotechnology is not electrical power Systems engineering but there were a group of potential functions to develop electrical, mechanical, thermal or chemical properties of electric power equipments. Repeatedly the financial features are grave out, but also a higher efficiency or a reduction of losses forecasts this novel technology and a winning manifestation in power systems engineering. In this paper the state of the art in nanotechnology, the option and claims in electric power systems engineering were examined. On the one offer novel materials for conductors and on the other dispense innovative insolents and varnish for insulators were taken into description. The intends for giant voltage insulation systems were to make bigger the lifetime, to optimize the life succession charges, to reduce the maintenance expenses, and to decrease the size or weight and to increase the efficiency. As an instance of a sensible function of nanotechnology the effects of a test progression with nano-coated ceramic insulators were at hand. The nano-coating was applied on the pottery surface and the extended term constancy was tested under a thermal and moist cycling process in a atmospheric chamber in natural conditions. As objective decisive factor for the extended term constancy the contact angle was observed by visual measurements in defined time periods. The assessments of the first test results look very victorious; the contact angles of the coated insulators were steadily towering for more than 30 degrees over the whole test period.**

Keyword- Nano Technology, Electrical power Systems, Contact angle measurement,

I. INTRODUCTION

In broad regions of research and applied science nanotechnology is by now at hand and the instant tie can obviously be assumed. presently to name two functions medics and biomedical engineers build up nano subdivisions for lump indicators, physicists and electronic engineers employ nanotechnology for semiconductors to build up the super computer. From this tip of vision it crashes like a challengeable nanotechnology and power systems engineering, but what does nanotechnology have to do in electrical engineering? Power system engineering where Megawatt of Power and thousands of Volts have the determining pressure on the everyday business, where does a technology of miniaturization of elements find its position in between? There were numerous prospects for application in power engineering, let me list some examples:

- Improvement of metallic conductors (reduction of losses)
- Improvements of insulators (raising of electrical
- insulation, mechanical stability, thermal load behavior, chemical resistance)
- Miniaturizing of design, reduction of used material, higher reliability
- Improvement of electromagnetic compatibility (EMV)
- Long-term improvement of efficiency and elongation of life time period

All of these ideas cannot be put into reality within days or months; it will take a middle-term to long-term period from the idea to research work, over first models and to industrial creation and the claim by the end users. Some researchers and clusters were investigating serious on the advance of nanotechnology for power function. A high state of anticipation gives the drop of ohmic losses at

metallic conductors using Carbon Nano Tubes (CNT). In [1] an idea for creating a future mega-low-resistivity material based on a carbon nano tube metal complex was at hand. In a simple effective-medium model it was shown that room temperature resistivity's 50% lesser than copper (Cu) is attainable. As per Figure-1.

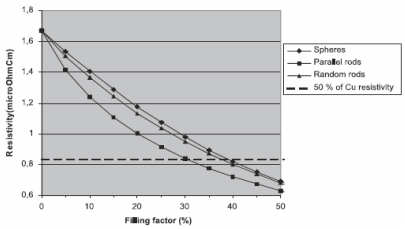

Fig-1: Resistivity in a Composite of Copper & Carbon Tubes

This research cluster has called this idea conductor with ultra low resistivity. This phenomenon is achievable because of the ballistic conducting carbon nano tubes. Their assets can be illustrated that the CNT have an electron mean free trail numerous arrays of magnitude longer than metals like copper (Cu) and Silver (Ag). This involves that a system with parallel-connected tubes can certainly will have a room-temperature resistivity far below the resistivity of predictable used metal conductors like Al, Cu and Ag. Assume that, if the ohmic resistance could be decreased for some percent, how essential would be an industrial invention of such a conductor be? Not only the electric losses could be diminished but the efficiency of cables is also improved.

And the thermal performance would be optimized and the material load is reduced. It is known that, one of the most governing periodic or ageing factors is the thermal heat on insulation systems according to Arrhenius Law. For better efficiency, a higher life-time and a better consistency would be specified. The conductor of mega-low resistivity is not appreciated by now, but nanotechnology gives hope to find new ways to realize the dream of all electrical engineers – the loss free electric conduction.

In other fields of nanotechnology, the progress of research work is going on faster. E.g. in the CIGRE WG D1.16 there were different subjects: "High Field Phenomena in Solid Insulation and Interfaces" reports of the state of the art at Interfaces in HVDC Extruded Cables, Low Voltage and High Field Phenomena, Polymer Nano composites and Interfaces in Composite Insulation. Using nano fillers in electrical insulators the properties of electrical, mechanical or thermal behavior can be influenced between its physical limits. Several test series have shown that the use of nano fillers provide good chances of success.

Different physical effects were used to archive the target, e.g. with nanotechnology the fillers of the surface of material structure is increased to the massive large, so that there should not be the surface effect much dominant as the volume effect. A change of the thermal behavior, a shifting of melting point, could be the consequence. Or the electrical treeing behavior is reduced by the nano fillers due to reduction of electrical field strength respectively of longer treeing distances. In [2] the influence of the nanotechnology the filler absorption on the behavior of materials was shown in Fig-2.

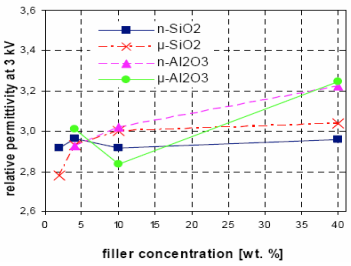

Fig-2: Influence of filler concentration.

With the disparity of the Nanotechnology filler absorption in insulating materials substantial properties like thermal conductance, electrical resistance to HV arcing, indulgence factor or virtual permittivity can be adjusted within close limits. One of the first come into used nanotechnology products was a material to improve the hydrophobic behavior of surfaces. The improvement of water disgusting surfaces was inspected very well. In [3] one of abundant test succession for convenient applications in power systems engineering is illustrated.

II. HYDROPHOBIC ASSETS OF SURFACES

Frequent problems of ceramic outdoor insulators are corona discharges, flashovers or leakage current due to air Humidity, rainfall in combination with dust of environmental pollution. Often also industrial pollution, salt fog or sand storms worsen the situation and accelerate the ageing of the porcelain surface [4]. The best flashover behavior and lowest leakage current shows a good hydrophobic surface of the insulator, which polymer insulators have.

In distinction to polymer surfaces clay insulators show a deprived hydrophobic feature. For this cause tries with a silicone coating of the clay surface were done with differing success. The main trouble was the set hurdles application and the long term constancy of the silicon coating. Since the expansion of nano technological products nano technological liquids were used for many purposes. In this research work, the related and long term constancy of Nano technological coated clay insulators should be inspected. For the description of the

hydrophobic assets of insulator surfaces the contact angle is a purpose constraint. For this cause the descriptions according to IEC Standard 62073 [5] was taken into consideration. At a surface which is inclined for an angle the dynamic contact angle consists of an advancing and a retreating angle according to Fig. 3. The static contact angle was not of concern for these analyses because insulator caps had an inclination of 15°.

Fig. 3: Contact Angle

III. TEST ITEMS AND TEST PLAN

All tests were functional at the same ceramic insulator type. At eight insulators the test plan was applied, two of them were not impregnated with the nano technological coating. The impregnation of the insulator surface with the coating was done according to the functional instruction of the Nano technological liquid creator. The ceramic insulators were aged synthetic in a atmospheric chamber with a test plan of temperature difference between +55°C and -20 °C and qualified air moisture between +92% and 52%.

In total more than 70 test cycles were applied in half year time period. At a group of two insulators are tested on expected aging procedure was applied over more than a few months. These two insulators were covered to outdoor climate under summer (up to+25 °C, dry, wet) and winter conditions (snow, -10°C) with expected pollution. The test conditions were tightening up for the half test time period because there should not be any fundamental change on the surface and the hydrophobic individuality. The coldness of the air moisture under zero degree at the insulator surface and the vanishing process under heating should present a hastened ageing process.

IV.CONTACT ANGLE MEASUREMENTS

The retreating and advancing contact angle was observed from the start of these analysis operations to the beginning test end. The contact angle was concluded optical with a digital camera; the pictures were estimated with realistic software. A sample of the contact angle fortitude is shown in Fig. 4. This measuring process has been done for numerous summits during the test and with dissimilar size of water drops start from 1 µl up to 100 µl in steps of 5 µl. The results of retreating and advancing contact angle have been recorded. The water drops were produced with a biomedical pipette where the drop size can be adjusted continuously between one and 200 µl. The measuring results were verified by applying the same water drop size two times.

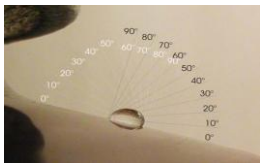

Fig. 4: Contac Angle Determination

V.CONCLUSION AND RESULTS

The results of the tests and contact angle measurements can be summarized as follows: The condition of the surface did not worsen, the nano coating passed the test very successful, no changes could be observed. The contact angle set aside approximately stable during the test period.

Between the coated and the non coated ceramic surface a big difference in the hydrophobic characteristic was observed. Fig. 5 illustrates the difference of the interfacial tension of coated and non coated insulators at different water drop sizes. The pictures on the left side show the shape of drops of the surface treated insulator. It is clear to see that the contact angles were much higher than at the untreated surface on the right side.

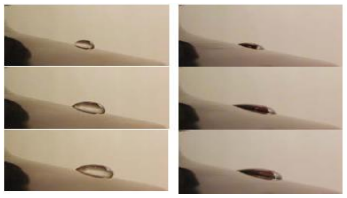

Fig-5: Interfacial tension at a water drop

The viewed contact angles in reliance of the water fall size were exemplified in Fig. 6. The advancing contact angle of the nano technological coated insulator was approximately stable at 90° for all water fall sizes; the retreating contact angle gives a light disgracing feature for better water fall volumes. The behavior for the non covered surface proved a light amplifying feature for the advancing angle and a light falling tendency for the retreating angle.

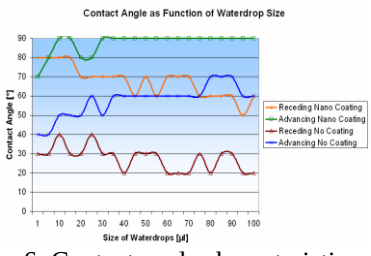

Fig. 6: Contact angle characteristic

VI. SUMMARY AND ACKNOWLEDGEMENT

Nano technological innovations were present in wide areas of electrical engineering. In electrical power engineering the actual state was demonstrated with different projects in the research and development, in special the ultra low resisistivity conductor, the influence of nano fillers for insulating materials and the coating for hydrophobic surfaces were discussed. The hydrophobic properties of six nano coated and two non coated ceramic insulators were tested under accelerated ageing conditions. Between the coated and the non coated surfaces a difference of the measured contact angles of 30° in average was observed. This value meets very well with recently published contact angle measurements [6], [7] of polymer surfaces. The nano coating showed no degradation after more than 70 ageing cycles within six month of test duration. The application of the nano surface is very simple and can be done at new and also at installed insulators. The authors are most grateful to the sponsors of the ceramic insulator producer, Tyco Electronics Austria [8] and the producer of the nano liquid, Nano gate Coating Systems Germany [9].

REFERENCES

[1]. O. Hjortstam, P. Isberg, S. Söderholm, and H. Dai, Can we achieve ultra-low resistivity in carbon nano tube-based metal composites?, Applied Physics A, Vol. 78, No. 8, 2004
[2]. S. Rätzke, J. Kinders berger, Erosion Behaviour of Nano Filled Silicone Elastomers, ISH 2005, paper C09
[3]. T. Andritsch, Nanotechnology in Electrical Engineering, Diploma Thesis 2006, TU Graz
[4]. M.Awad, H.Said, B.A.Arafa, A.Nosseir, Long Term Aging of Silicone Rubber Insulators due to Sandstorms, CIGRE 2000, Paper 15-2005
[5]. IEC/TC 62073, 2003-06: Guidance on the measurement of wet ability of insulator surfaces
[6]. [6] F. Exl, J. Kindes berger, Contact Angle Measurement on Insulator Surfaces with Artificial Pollution Layers and Various Surface Rough nesses, ISH 2005, Paper D-47
[7]. J. Wu, C. Cornelissen, A. Schnettler, Investigation on the flashover performance of nanostructured insulating surface with „Lotus-Effect®“ under wet conditions, ISH 2005, Paper D-15
[8]. http://www.tycoelectronics.com/
[9]. http://www.nanogate.de/
[10]. Christof Sumereder, Michael Muhr, “The Prospects Of Nanotechnology In Electrical Power Engineering”, 19th International Conference On Electricity Distribution, Vienna, 21-24 May 2007, Paper 0594.

Authors

Dr. Sardar Ali He has completed his Primary to SSLC studies from Humnabad, Dist. Bidar, Karnataka State. India. He has completed his Diploma in Electrical Engineering from Govt. Polytechnic, Bidar, Karnataka State, India and Graduation AMIE in Electrical Engineering from “The Institution of Engineers (India)”, Kolkata, West Bengal, India. His native place is Sirkatnalli Village of Tq & Dist Bidar, Karnataka State, India. Prof. Dr. Sardar Ali received M.Tech (EPS) Degree and PhD (EE) Degree respectively from JNTU Anantapur, Andhra Pradesh, India. And Received the Second PhD (EEE) Degree from Floret Global University, The Republic of Panama, South America. Formerly he was the Professor of EEE & Principal (Ratified by JNTUH) at Royal Institute of Technology & Science, Chevella,

Affiliated to JNTUH and Approved by AICTE New Delhi, India Presently he is working as Professor & Head of EEE Department, at Deccan College of Engineering & Technology, (Affiliated to Osmania University and Approved by AICTE). Darussalam, Nampally, Hyderabad-500001, Telangana State, India. He has published & Presented 52 Technical Research Papers in International Journal, National Journals & Conferences. His research interest includes:- [Power Quality, FACTS Technology, Deregulation, Multi-level inverters and High Voltage Engineering. AI-Technique in Electrical Engineering, Neural Network & Fuzzy logic, Wireless Communication with embedded Systems, Sensor Technology for the Oil Pipes, Role of Electricity to protect decay of steel in RCC roof & columns, Solar Energy System, Transmission & Distribution systems with protection and Advanced Electrical Machines.]

He has over 36 Years of Experience, of Academic and Industry, out of which 7 Years Construction field Experience in Gulf (Saudi Arabia). He has been invited for many technical lectures in various National conferences. He has authored several Books in Electrical Engineering, which are in the use of curriculum of M.Tech & B.Tech, and also in the use of Practicing Engineers in Electrical field. He is also the visiting professor for GATE, APSEB, RRB and MES. He is Electrical Load Designer, Electrical & Electronics System Designer for High-Rise Buildings.

He is the reviewer of several International & National Journals and Conferences. He has conducted several

International conferences, Technical seminars and workshops in Electrical Power Systems. He has been awarded the best teacher award by RITS in 2013 and many international appreciation awards from international companies, like Royal Commission Jubail has awarded as "Best Electrical Supervisor" He has guided more than 500 M.Tech & B.Tech Projects. He has been awarded "Bharat Jyothi Award" in 2016 by Bharat Publishing Company, New Delhi; India.

He has been selected as the winner of Higher Education Leadership Meet-HELM 2018, "Lifetime Achievement in engineering leadership" Awarded, by International organization "Venus International Foundation" on January 5, 2019. For his continuous engineering services of his field. He has conducted Practical VIVA VOCE for B.Tech/B.E under JNTUH/O.U and Conducted VIVA VOCE for M.Tech EPS & PE of JNTUH. He is the Paper setter for university examination in the branch of Electrical Engineering. He is PhD Guide for many Indian Universities. He was the Editor of conference proceedings RITS ICAEM-2013 and the Journal."The International Journal of Engineering and Technology" is quarterly published of 2013. He is the Electrical Chartered Engineer and third part inspector in MNCs.

 Miss Reshma Sultana Husna (M.Tech BMII) Received B.E Degree in Electronics and Instrumentation Engineering in First Class with Distinction, Pursuing PG Degree M.Tech in Bio-Medical Engineering & Industrial Instrumentation (BMII) IV-Semester (Project) from PDA College of Engineering, Kalaburagi, Karnataka State, India. Affiliated to VTU. Approved by AICTE New Delhi