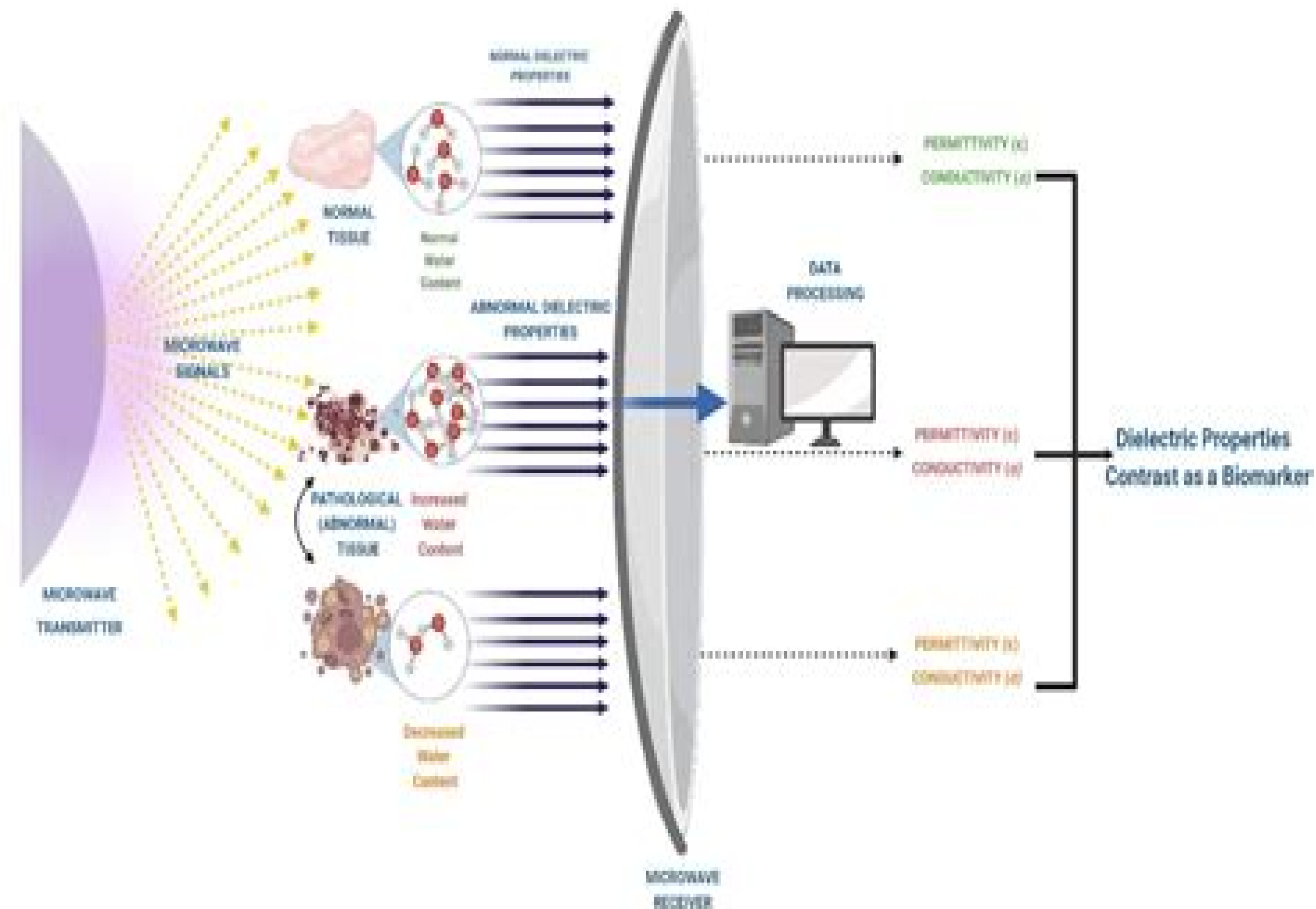


PRINCIPLE OF DIELECTRIC PROPERTIES CONTRAST SENSING USING MICROWAVES



Microwave Properties Graphene Bernard Plaais

Ali M. Ammar



Microwave Properties Graphene Bernard Plaais:

Microwave Properties of Graphene Bernard Plaais, Andreas Betz, 2015-12-07 The authors discuss electronic transport in 2 dimensional graphene and its implications for the design and performance of high speed electronic devices and photodetectors It aims to introduce engineers and scientists to the emerging field of graphene electronics which is very different from existing systems such as silicon MOSFETs or III V HEMTs The authors propose a global approach to graphene electronics ranging from basic concepts such as that of Dirac fermions to their implication in technological issues including device design and characterization

Measurement of the Dielectric Properties of Free-standing Graphene Oxide Paper Using Microwave Techniques Anthony Ubah, 2021 The world is facing an unprecedented problem with waste electronics and electrical equipment WEEE The amount of WEEE continues to increase annually and toxic materials used within their printed circuit components continue to leach into the environment Existing strategies such as recycling have been ineffective remedies to these problems Printed circuits based on graphene oxide a derivative of graphene may help solve this problem Graphene oxide is easily recycled by dissolution in water with the primary byproduct being humic acid a family of compounds commonly found in natural water bogs Historically research on graphene oxide has been focused on narrow applications in electronic elements However graphene oxide also has the potential to form the entire printed circuit board by simultaneously serving as the mechanical support the dielectric and with reductive treatment the conductive traces This thesis is a preliminary investigation into the dielectric properties of graphene oxide and an attempt to produce conductive traces of reduced graphene oxide The loss tangent of graphene oxide is extracted from S parameter microwave measurements using a transmissive coplanar waveguide transmission line where graphene oxide is the dielectric Additionally a dose test method is developed to ascertain ideal scanning laser parameters for the selective area photoreduction of graphene oxide for future development of graphene oxide reduced graphene oxide printed circuit boards

Microwave Enabled Dispersion of Highly Conductive Carbon Nanomaterials and Their Interfacial Assemblies Pui Lam Chiu, 2013 Due to its phenomenal mechanical characteristics and remarkable electrical properties graphene a perfect single atomic thick two dimensional lattice carbon layer has attracted extensive attention in nanoscience and condensed matter physics With all the similarities it is believed that graphene can compete with or even surpass carbon nanotubes in many fields and it is expected to replace silicon in many electronic applications and in other advanced technologies A single layer of graphene sheet was first isolated in 2004 from highly oriented pyrolysis graphite with Scotch tape The invention of The Scotch tape method seems very simple and it has enabled a whole new path in many graphene based research areas It also resulted in Andre Geim and Konstantin Novoselov s winning the 2010 Nobel Prize in physics This solvent free method however suffers from low yields low repeatability and being extremely labor intensive Solution based fabrications have shown to be able to overcome these problems However the next challenge in the graphene research field and applications is the tedious chemical path that is

required to convert oxidized graphene using toxic chemicals such as hydrazine. In this thesis we first developed a novel and an unprecedentedly fast and simple approach to directly exfoliate graphite flakes with the aid of both nitronium ion and microwave irradiation with the aim of solving the main research problems in the field. To utilize the produced graphene in practical applications, our knowledge of interfacial science was exploited to controllably self assemble these wonderful materials into desired structures. The research results combined with an introduction of the development and future aspects of these fields will be presented in the five chapters of this thesis. Chapter 1 will include a general overview of basic but important information concerning the two main carbon based materials carbon nanotubes and graphene. Their structures, physical properties, methods of fabrications and applications will be discussed in depth. In addition, interfacial science for self assembly of nanomaterials will be summarized. In Chapter 2, an efficient, simple and promising way to prepare graphene sheets directly from graphite flakes with the aid of nitronium ions and microwave irradiation will be presented. Knowledge of the chemistries related to nitronium ions and microwave has enabled us to purposely omit strong oxidants such as KMnO_4 with an aim not to heavily oxidize the materials as many methods are based on this. Reduction reactions can be completely avoided. Experimental results demonstrate that this non destructive method resulted in concentrated, stable dispersions of flat, high quality, conductive graphene sheets in both aqueous and organic solvents. This mildly oxidized material was extensively characterized by atomic force microscope (AFM), infrared spectroscopy (FTIR), ultraviolet visible spectroscopy, thermogravimetric analysis (TGA), X-ray photoelectron spectroscopy (XPS), Raman spectroscopy and transmission electron microscopy (TEM). In chapter 3 we extended the nitronium ions and microwave enabled dispersed approach to carbon nanotubes. Different sources of both single walled carbon nanotubes (SWNTs) and multi walled carbon nanotubes (MWNTs) were tested and the results showed that all the CNTs from different sources can be quickly dispersed into aqueous solutions with remarkably high concentrations compared to those of graphene solutions even though the same parameters were applied during dispersion. We found that depending on the existence of a small amount of defects from the original CNT sources, the yield and quality of the dispersed CNTs are varied. With a long term aim of fabricating highly transparent and conductive films to replace Indium tin oxide (ITO) in a wide variety of optoelectronic devices, in Chapter 4 a new method referred to as an interfacial self assembly approach is developed to assemble the microwave dispersed graphene and CNTs into highly conductive films. The self assembly behavior of graphene, CNT and a mixture of graphene and CNT with different ratios were studied separately and the knowledge obtained was used to fabricate graphene, CNT and a hybrid of graphene/CNT thin films at an oil/water interface respectively. Compared to the generally used vacuum filtration method, this new approach does not need any membrane; thus, theoretically any size film can be easily fabricated. To transfer the formed films to substrates for practical applications, a simple film transferring method was also developed. The films fabricated with different film fabrication methods will also be compared and a systematic study on how the compositions of these two materials affect the

performance of the final films will be summarized The dispersed graphene sheets are often composed with graphene sheets of different sizes to separate them for different applications In Chapter 5 interfacial self assembly reactions were also applied to separate the graphene sheets based on their size and electronic dependent surface energies Chapter 6 will then focus on fine tuning the surface chemistry of the graphene sheets and the oil water ratio to efficiently emulsify the graphene sheets into core shell capsules for drug delivery applications Poly N isopropylacrylamide PNIPAA a thermally sensitive polymer is introduced to form a temperature sensitive and stable oil in water microemulsion with the ability to release the encapsulated materials in a graphene PNIPAA shell above its transition temperature Experimental observations show that the emulsion with graphene has a slightly increased transitional temperature from 34 C to 38 C

Reduction of Graphene Oxide Using Microwave and Its Effect on Polymer Nanocomposites Properties Ali M. Ammar,2018 Graphene and graphene oxide GO as Nano fillers have been used in numerous applications Reduced graphene oxide for example is one of the most attractive additives that have been targeted to use in polymer nanocomposites due to its strong mechanical properties electric conductivity and gas barrier properties However there are many of obstacles make it difficult to be produced in large quantity at low cost and safe processes There are many methods to reduce graphene oxide rGO and one of the interesting one that used in this research project is solution reduction of graphene oxide using Microwave In this project we have investigated the time effect on reduction of graphene oxide in Microwave and its polymer application properties We have three sub projects that have been studied for the comparison of adding graphene oxide to different time reduced graphene oxide at the same weight contents and conditions The first project the effect of GO and rGO on polymer thin films blend phase separation We observed that the domain size of the polymer blend phase separation changed with adding graphene oxide comparing to reduced graphene oxide due to the interaction with polymer chain The second project we have investigated the addition of GO and rGO on polymer gas barrier properties Two gases have been tested Oxygen O₂ and Carbon dioxide CO₂ at two different pressures The remarkable result of this project is that the addition of rGOs worked as a barrier for these gases comparing to GO and Pure films The last project we have studied the effect of adding GO and rGO on polymer fibers for its oil sorption capacity application and the structure morphology of these fibers

Hierarchy of Electronic Properties of Chemically Derived and Pristine Graphene Probed by Microwave Imaging ,2010 Local electrical imaging using microwave impedance microscope is performed on graphene in different modalities yielding a rich hierarchy of the local conductivity The low conductivity graphite oxide and its derivatives show significant electronic inhomogeneity For the conductive chemical graphene the residual defects lead to a systematic reduction of the microwave signals In contrast the signals on pristine graphene agree well with a lumped element circuit model The local impedance information can also be used to verify the electrical contact between overlapped graphene pieces

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