List of Works(Publications)

Paper title : *Predicting Energy Demand in Semi-Remote Arctic Locations*

Journal : Energies, 2021

DOI : *https://doi.org/10.3390/en14040798*

Authors : Odin Foldvik Eikeland, Filippo Maria Bianchi, Harry Apostoleris, Morten Hansen, ***Yu-Cheng Chiou***, Matteo Chiesa

Abstract : Forecasting energy demand within a distribution network is essential for developing strategies to manage and optimize available energy resources and the associated infrastructure. In this study, we consider remote communities in the Arctic located at the end of the radial distribution network without alternative energy supply. Therefore, it is crucial to develop an accurate forecasting model to manage and optimize the limited energy resources available. We first compare the accuracy of several models that perform short-and medium-term load forecasts in rural areas, where a single industrial customer dominates the electricity consumption. We consider both statistical methods and machine learning models to predict energy demand. Then, we evaluate the transferability of each method to a geographical rural area different from the one considered for training. Our results indicate that statistical models achieve higher accuracy on longer forecast horizons relative to neural networks, while the machine-learning approaches perform better in predicting load at shorter time intervals. The machine learning models also exhibit good transferability, as they manage to predict well the load at new locations that were not accounted for during training. Our work will serve as a guide for selecting the appropriate prediction model and apply it to perform energy load forecasting in rural areas and in locations where historical consumption data may be limited or even not available.

Keywords: energy load predictions; statistical- and machine-learning-based approaches; short-term load forecasting; longer forecasting horizons; transferability predictions.

Paper title : *Predicting the suitability of lateritic soil type for low cost sustainable housing with image recognition and machine learning techniques*

Journal : Journal of Building Engineering, 2020

DOI : *https://doi.org/10.1016/j.jobe.2020.101175*

Authors : Tuza A Olukan, ***Yu-Cheng Chiou***, Cheng Hsiang Chiu, Chia-Yun Lai, Sergio Santos, Matteo Chiesa

Abstract : From a sustainability point of view, laterites-compressed earth bricks (LCEB) are a promising substitute for building structures in place of the conventional concrete masonry units. On the other hand, techniques for identifying and classifying laterites soil for compressed earth bricks (CEB) production are still relying on direct human expertise or 'experts'. Human experts exploit direct visual inspection and other basic senses such as smelling, touching or nibbling to generate a form of binomial classification, i.e. suitable or unsuitable. The source of predictive power is otherwise supposed to be found in color, scent, texture or combinations of these. Lack of clarity regarding the actual method and the possible explanatory mechanisms lead to 1) difficulties to train other people into the skills and 2) might also add to apathy to using CEB masonry units for housing. Here we systematize the selection method of experts. We chose imaging analysis techniques based on 1) easiness in image acquisition (Digital Camera) and 2) availability of machine learning and statistical techniques. We find that most of the predictive power of the 'expert' can be packed into visual inspection by demonstrating that with image analysis alone we get a 98% match. This makes it practically unnecessary the study of any other 'expert' skills and provides a method to alleviate the housing problems dealing with material construction in the developing world.

Paper title : *Direct Measurement of the Magnitude of van der Waals interaction of Single and Multilayer Graphene*

Journal : Langmuir, 2018

DOI : *https://doi.org/10.1021/acs.langmuir.8b02802*

Authors : ***Yu-Cheng Chiou***, Tuza Adeyemi Olukan, Mariam Ali Almahri, Harry Apostoleris, Cheng-Hsiang Chiu, Chia-Yun Lai, Jin-You Lu, Sergio Santos, Ibraheem Almansouri, Matteo Chiesa

Abstract : Vertical stacking of monolayers via van der Waals assembly is an emerging field that opens promising routes toward engineering physical properties of two-dimensional (2D) materials. Industrial exploitation of these engineering heterostructures as robust functional materials still requires bounding their measured properties so to enhance theoretical tractability and assist in experimental designs. Specifically, the short- range attractive van der Waals forces are responsible for the adhesion of chemically inert components and are recognized to play a dominant role in the functionality of these structures. Here we reliably quantify the strength of ambient van der Waals forces in terms of an effective Hamaker coefficient for CVD- grown graphene and show how it scales by a factor of two or three from single to multiple layers on standard supporting surfaces such as copper or silicon oxide. Furthermore, direct measurements on freestanding graphene provide the means to discern the interplay between the van der Waals potential of graphene and its supporting substrate. Our results demonstrated that the underlying substrates could be controllably exploited to enhance or reduce the van der Waals force of graphene surfaces. We interpret the physical phenomena in terms of a Lifshitz theory-based analytical model.

Data visualization : *Copper*, *SiO2*, and *Free-standing* for three different substrates.

Paper title : *Impact of short duration, high-flow H2 annealing on graphene synthesis and surface morphology with high spatial resolution assessment of coverage*

Journal : Carbon, 2017

DOI : *https://doi.org/10.1016/j.carbon.2017.09.048*

Authors : Sohail Shah, ***Yu-Cheng Chiou***, Chia Yun Lai, Harry Apostoleris, Md. Mahfuzur Rahman, Hammad Younes, Ibraheem Almansouri, Amal Al Ghaferi, Matteo Chiesa

Abstract : Treatment of graphene growth substrates with H_2 has long been known to impact the quality of deposited graphene. However, the parameters for hydrogen treatment that are considered the optimum e very long anneals under low hydrogen concentrations e are often undesirable for practical reasons. In this paper we optimize anneal parameters for fast anneals of <1 h, via investigation of both substrate surface modification and graphene growth quality using a number of traditional and novel experimental techniques. Our results indicate a dual effect of H_2 annealing on the surface morphology of the copper substrate, and consequent graphene growth quality, whereby H_2 passivates and smoothens the Cu surface, causing it to become morphologically more favorable for graphene growth, but may in large quantities make the surface less chemically favorable, limiting the quality of grown graphene. Moreover, we use a novel method based on Atomic Force Microscopy (AFM) for higher spatial resolution analysis of the homogeneity of graphene using maps of the Hamaker coefficient.

Paper title : *Spectral management for temperature control in photovoltaic systems*

Journal : OSA, 2017

DOI : *https://doi.org/10.1364/PV.2017.JW5A.22*

Authors : Harry Apostoleris, ***Yu-Cheng Chiou***, Matteo Chiesa, Ibraheem Almansouri

Abstract : Today's photovoltaic panels can generate 3-4 times more heat than electricity, degrading performance and heating the surroundings. We assess spectral management approaches to minimize this heating or recover waste heat for useful purposes.

Paper title : *Spectral splitting for thermal management in photovoltaic cells*

Event : SPIE Optical Engineering + Applications, 2017, San Diego, California, United States

DOI : *https://doi.org/10.1117/12.2273680*

Authors : Harry Apostoleris, ***Yu-Cheng Chiou***, Matteo Chiesa, Ibraheem Almansouri

Abstract : Spectral splitting is widely employed as a way to divide light between different solar cells or processes to optimize energy conversion. Well-understood but less explored is the use of spectrum splitting or filtering to combat solar cell heating. This has impacts both on cell performance and on the surrounding environment. In this manuscript we explore the design of spectral filtering systems that can improve the thermal and power-conversion performance of commercial PV modules..

Thesis title : *Microwave Dielectric Ceramic*

Master Thesis : University of Manchester, 2011

Abstract : Due to the telecommunication market expands and develops rapidly; both performance enhancement and lower price become main requirement of the microwave devices. $Ba_3Co_{0.7}Zn_{0.3}Nb_2O_9$ (BCZN) series dielectric ceramics with complex perovskite structure contain excellent dielectric properties, as well as low cost, but they are very sensitive to the process. Therefore, to investigate the factors impact to Qxf has been studied in this project. In this study, different heat treatment condition by controlling the sintering time, thickness and volume of BCZN systems are investigated. Previous study indicated ordering degree and domain size would influence Qxf value in perovskite structure system, therefore, the ordering parameter of B-site cation and domain size will obtain by the analysis of X-ray powder diffractiometer. Otherwise, the microstructure will be explored by SEM and optical microscopy. The result show, Qxf value can be improved by increasing sintering time and reducing thickness. In this study, BCZN series microwave dielectric ceramics obtain the best Qxf value=99976 GHz when sample sintering at 1450°C for 4 hours and with 4.82 thickness.

Keywords : BCZN, dielectric, perovskite, B-site cation, ordering degree, domain size.