ANSOLE Scientific Meeting in Côte d´Ivoire

ASMCI 2018

Université Felix Houphouet-Boigny, Abidjan

10 November 2018



Final Event Booklet including Report & Photos

ANSOLE Scientific Meeting in Côte d´Ivoire

ASMCI 2018

„Promoting Low-Cost (Inter)national Scientific Networking Meetings on Sustainable Energetics in Africa!!!“

Université Félix Houphouët-Boigny, UFR SSMT extension
ex-INSET / LPMCT Salle INFO1

Saturday, 10 November 2018

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About ANSOLE:

The African Network for Solar Energy (ANSOLE) promotes research, education and training in the field of renewable energies among Africans as well as non-Africans with a special focus on - and relationships with - Africa.

As outlined in its by-laws, ANSOLE supports non-profit activities in the field of development aid and cultural exchange with the aim of strengthening the dialogue between the North and African countries (north-south) and among African countries (south-south) on renewable energy.

It endorses the use of solar energy to the benefit of the social and economic development of Africa as well as environmental protection through:

- Education and training of African scientists, experts and students
- Exchange of students and visiting scientists
- Workshops, conferences and meetings in Africa
- Organising and implementing projects and programmes on renewable energy
- Promoting capacity building in the use of renewable energy in Africa for all

As a non-profit and charitable organization registered in Jena Germany (as ANSOLE e.V.), it is locally involved in educational issues related to the 17 Sustainable Development Goals (SDGs) and in arts and culture. In addition, it offers a platform of articulation of students and migrants from Africa with the aim to facilitate their integration and acceptance within the German society using the project designated AMAH (Anlaufstelle für Menschen afrikanischer Herkunkft), which is financed by the City of Jena and the Federal State of Thuringia.

Freistaat Thüringen Beauftragte für Integration, Migration und Flüchtlinge

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Programme

2.00-8.20pm

TIME	ACTIVITY	Participants
2:00-2:20	Registration	All participants
2.20-2:30	Welcome addresses	Profs. D.A. M. Egbe/Y. Ngoran/O. Obrou/J.T. Zoueu
2.30-3:00	Materials Design Principles for organic Solar Cells: Case Study on Poly(aryleneethynylene)-alt-Poly(arylene-vinylene)s	**D. A. M. Egbe**/ Johannes Kepler University Linz, Austria
3:00-3:20	Elaboration de matériaux semiconducteurs en couches minces par des techniques à bas coût pour applications en photovoltaïque et capteurs de gaz	**B. Hartiti**/ FST de Mohammedia, Université Hassan II de Casablanca, Morocco
3.20-3:40	Estimation and prediction of the national potential of solar energy	**Y. Ngoran**/ University of Cocody, Abidjan
3:40-4:00	Solar cell main recombination mechanisms characterization with the temperature-dependent open circuit voltage	**A.Darga** /Paris-Sorbonne Unversity, France
4:00-4:20	**Coffee Break**	
4:20-4:40	Low cost solar energy, Perovskite solar cell	**A.P. Kouakou**/ University Nangui Abrogoua, Abidjan
4:40-5:00	Solution for the optimisation of solar dryer collector	**A.S. Koffi**/University of Cocody, Abidjan
5:00-5:20	Design, realization and cooking test of a spherical concentrator solar cooker	**S. Touré**/ University of Cocody, Abidjan
5:20-5:40	Realization of a low energy consumption solar medical refrigerator adapted for poor-areas in electricity	**A.P.A. Kouassi**/ University of Cocody, Abidjan
5:40-6:00	Characterization of natural dye extracted from Rauvolvia vomitoria for dye- sensitized solar cells	**J.K. Datte**/ University of Cocody, Abidjan
6:00-6:20	Comparaison et analyse des performances d'un moteur diesel fonctionnant à l'huile de jatropha préchauffée et au gazole	**Y.W. Gounkaou/** Université Ouaga I Pr JOSEPH KI-ZERBO, Burkina Faso
6:20-6:40	Aluminum-doped zinc oxide films deposited by sol-gel via spray coating technique	**F.K. Konan/** Université Nangui Abrogoua, Abidjan
6:40-7:00	Gestion optimale de l'alimentation d'un moteur dual-fuel couplé à une installation de gazéification de type batch	**Ali Diane/** Université Ouaga 1 Pr Joseph KI-ZERBO, Burkina
7:00-7:20	Les énergies de sources renouvelables, accélérateur de l'électrification rurale décentralisée: Cas de la Côte d'Ivoire	**TOURE Minayegnan /** *INP-HB, Yamoussoukro, Côte d'Ivoire*
7:20-7:40	Remote sensing spectroscopy applied to environmental assessment	**J.T. Zoueu/** INP-HB, Yamassoukro, Côte d'Ivoire
7:40-8:00	Realization of remote WebSIG of photovoltaic micro-networks in Conakry (Guinea)	**K. H. Kpegne/** University of Cocody, Abidjan
8:00-8:20	Award of Certificates of Participation and Closing Address	**D. A. M. Egbe**, ANSOLE Coordinator

Abstracts and Biographies of Lecturers

Materials Design Principles for organic Solar Cells: Case Study on Poly(aryleneethynylene)-alt-Poly(arylene-vinylene)s

Daniel Ayuk Mbi Egbe

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The first part of the lecture focuses on materials design principles for high efficient organic solar cells (OSC) [1] Recent development on non-fullerene acceptors (NFAs) which has led to the present state-of-the art OSC power conversion efficiency of 17.3% will be presented.[2]
In the second part, the focus will be laid on photoactive systems widely known as poly(arylene-ethynylene)-*alt*-poly(arylene-vinylene)s (**PAE**–**PAV**s).[3] The systematic study of side chains effect on photovoltaic response of this class of materials will be presented and discussed.

Acknowledgement: FWF is acknowledged for financial support through grant N° I 1703-N20

References

1. a) Cheng Y.-J *et al. Chem. Rev*. **2009**, *109*, 5868. b) H. Zhou *et al*. *Macromolecules* **2012**, *45,* 607-632, c) Chochos, C. L. *et al*. *Prog. Polym Sci.* **2011**, *36*, 1326-1414.
2. L. Meng *et al*., *Science* 10.1126/science.aat2612 (2018).
3. a) Egbe, D. A. M. *et al*. *Prog. Polym. Sci.* **2009***, 34,* 1023-1067. b) Egbe, D. A. M *et al*. *J. Mater. Chem.* **2011**, *21*, 1338 – 1349.



Professor Daniel Ayuk Mbi Egbe is of Cameroonian origin. He obtained a BSc in Physics and Chemistry at the University of Yaounde, Cameroon, in 1991 before moving to the Friedrich Schiller University of Jena, Germany, where he successfully completed a MSc in Chemistry (1995), PhD in Organic and Macromolecular Chemistry(1999) and a Habilitation in Organic Chemistry (2006). After scientific stays at the Max-Planck Institute of Polymer Research in Mainz, Germany (2006), Technical University of Eindhoven, Holland (2006-2007) and Technical University of Chemnitz, Germany (2007-2008), he moved to the Johannes Kepler University Linz, Austria, in 2009, where he presently researches and coordinates the ANSOLE (www.ansole.org)and BALEWARE (www.baleware.org) networks. He has published morethan 120 peer-reviewed articles. He speaks 5 languages and is father of 4 children. Contact: Daniel.egbe@ansole.org/Daniel_ayuk_mbi.egbe@jku.at, Skype: danielegbe1

Elaboration de matériaux semiconducteurs en couches minces par des techniques à bas coût pour applications en photovoltaïque et capteurs de gaz

-Bouchaib HARTITI
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Les matériaux semiconducteurs en couches minces, ont toujours eu un intérêt grandissant pour les applications de photovoltaique et capteurs de gaz particulièrement les cellules solaires de deuxième génération et les capteurs chimiorésistifs
Dans ce travail nous donnerons une présentation de l'équipe du groupe GMEEM&DD et une synthèse sur les résultats obtenus sur un certain nombre de matériaux binaire, ternaire et quaternaire par l'intermédiaire de techniques d'élaboration à bas coût (Spray pyrolysis, Sol Gel associé au spin coating ou dip coating, CBD ou électrodéposition). Les résultats obtenus par caractérisations structurelle, morphologique, optique et électrique ont montré que les couches minces élaborées sont comparables à ceux de la littérature.

-Mots Clés: ZnO, CdS, In_2S_3, CIS, CIGS, CZTS, photovoltaïque, Capteurs de gaz

Remerciements: Remerciements l'ICTP, les laboratoires partenaires LMOPS et LCOMS

-**References**

1. *Synthesis of doped and undoped TiO_2 thin films prepared by sol gel*, Z. Essalhi, B. Hartiti, M. Siadat, P. Thevenin and A. E. Lfakir,*International Renewable and Sustainable Energy Conference (IRSEC),Marrakech, Morocco, 2016, pp.1145- 1148. IEEE Publisher (2017). Doi: 10. 1109 /IRSEC .2016 .79 83878.*
2. *Effect of F-doping on structural, electrical, and optical properties of ZnO thin films for optoelectronic application*, Y. Ammaih, B. Hartiti, A. Ridah, A. Lfakir, B. Marí Soucase and P. Thevenin, *International Renewable and Sustainable Energy Conference (IRSEC), Marrakech, Morocco, 2016, pp. 208- 211. IEEE Publisher (2017). doi: 10.1109/IRSEC.2016.7983904*.
3. *Optoelectronics properties of TiO_2:Cu thin films obtained by sol gel method*, Z. Essalhi, Bouchaib Hartiti, Lfakir Abderrazak, Philippe Thevenin*, Optical and Quantum Electronics 49(9), August 2017*
4. *Effect of vanadium doping on ZnO sensing properties synthesized by spray pyrolysis*, Zahira El khalidi, Elisabetta Comini, Bouchaib Hartiti, Abderrahim Moumen, Hashitha M.M.Munasinghe Arachchige, Salah Fadili , Philippe Thevenin, Abderrafi Kamal, *Materials & design 139, October 2017*



Professeur bouchaib Hartiti est diplomé de l'Université Mohamed V par l'obtention d'un doctorat d'état es sciences physique en 1996 après un doctorat de l'université Louis Pasteur de Strasbourg en 1990. Il a été chercheur contractuel au CNRS de Strasbourg de 1990 à 1994 et chercheur libre de 1994 à 1996 au même laboratoire PHASE.
Depuis 1996, Bouchaib HARTITI est professeur de l'enseignement supérieur à la faculté des sciences et techniques de Mohammédia et chercheur scientifique de cet établissement avec une gestion et participation dans de nombreux projets de recherche nationaux et internationaux. Le professeur Bouchaib HARTITI est chercheur associé au centre international de la physique théorique ICTP depuis 2014. Site web: https://www.researchgate.net/profile/Bouchaib_Hartiti , Email: bhartiti@gmail.com

Estimation and prediction of the national potential of solar energy

Yao N'GORAN
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This paper describes a pilot project to implement, within the framework of the project PReSeD-CI EPNES (2015-2017) of the program AMRUGE of the Contrat de Désentêtement et de développement (C2D), a solar monitoring network in Côte d'ivoire with a Weather forecasting and equipment management device consisting of automatic weather stations for measuring solar radiation and climatic weather parameters on the extent of the territory of Côte d'ivoire. A network of solar monitoring stations is often deployed to evaluate a possible site location for investors to verify the bank's feasibility of the facility. It provides data for research on technology, quality control, System type selection, maintenance planning, monitoring of operating efficiency and production forecasting, as well as an overview of Results of the exploitation of the acquired data.

-Keywords: Solar radiation, measuring station, solar radiation Atlas, solar irradiation, cartography

-**References**

1.Yao N'GORAN, 2011, *Establishing of west Africa solar radiation atlas: 1- Preliminary study of solar radiation climatology in Côte d'Ivoire,* ICPSR Journal "ISESCO Science and Technology Vision", Vol.7, N° 11 (may 2011), 11-19.

2. ZAHER A., N'GORAN Y., THIERY F., GRIEU S., and TRAORÉ A., **2017**, *Fuzzy rule-based model for optimum orientation of solar panels using satellite image processing*13th European Workshop on Advanced Control and Diagnosis (ACD 2016), IOP Publishing, IOP Conf. Series: Journal of Physics: Conf. Series 783 , 2017, Vol 783, N° 1 page 012058



Dr. N´GORAN Yao is a solid state physicist and a specialist in solar energy. He holds a postgraduate doctoral of solid physic on 1985 and a PhD thesis of State in Physical sciences on March 17, 2005. He was recruited as an assistant in the Department of Physics at the former Faculty of Science and Technology of the National University of Côte d'ivoire from 1985 to 1987 and as Assistant master since 1987. In 1998, He is member of the laboratory of condensed matter physics and technology (LPMCT) where he served as adjunct Director from 1998 to 2005 and then as director from 2005 to 2008. From Nov. 2014 to Sept. 2018, he was a porter and coordinator, in the framework of the Debt and Development contract (C2D), of a project on " Estimation and prediction of the national potential for solar energy and applications for drying agricultural products. Since Sept. 2018, he is the promoter of the project start-up Serima Group for the creation of an innovative company. Contact: nygoran@gmail.com

Solar cell main recombination mechanisms characterization with the temperature-dependent open circuit voltage

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There is a strong research effort to develop a low cost and high efficiency solar cell in order to reach the ultimate cost potential of this technology. Different strategies are being investigated: low cost fabrication methods, new geometries using ultrathin film for light absorption or trapping, tandem solar cell by using traditional crystalline semiconductors (Si, III-V) as bottom junction and thin-film solar cell as top junction. The common features of these different strategies is the formation of traps states which can be introduced during the fabrication process. In order to accelerate the research and development (R&D), it is important to develop characterization tools for a rapid evaluation and optimization the solar cell device performances.
In particular, the identification and localization of the main recombination paths within the solar cell device is of great relevance to evaluate which part (interface/contacts or absorber layer) of the cell is the limiting factor.
The temperature-dependent open circuit voltage (Voc (T)) measurements technique is a powerful method to characterize recombination mechanisms. Indeed, it does not require a complex fitting procedure.
Voc (T) measurements technique has been widely used to characterize the recombination mechanisms in thin films solar cells, including CIGS, CdTe and CZTS devices. In this presentation, we will show results on the evaluation of the technique with the well-known solar cell simulation program in one dimension, SCAPS. We will also show how this technique can be used to characterize PV modules under real operating conditions (Burkina Faso).

Keywords: Solar cells characterization, recombination, real operating conditions PV modules characterization



Dr. Arouna Darga is a senior lecturer in electrical and electronic engineering at Sorbonne Université, in France. Born in Ouagadougou, Burkina Faso, where he completed all his studies until his master's degree in pure physics at Ouaga I Pr Joseph Ki-Zerbo University of Ouagadougou, he get a PhD in electrical engineering at Sorbonne Université.
He is a scientist at the Laboratory of Electrical and Electronic Engineering of Paris at CentraleSupelec. He is an expert in advanced modeling and characterization of photovoltaic cells and modules within the Photovoltaic Institute of Île-de-France. His research focuses on the development of experimental techniques for the detection and quantification of electronic parameters limiting the performance of photovoltaic cells, modules and systems. He is co-author of several scientific articles. Arouna Darga is the national representative in France of the ANSOLE network. Email: ardarga@gmail.com

Low cost solar energy, Perovskite solar cells

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The electricity lack is a real problem for populations far from the electrical network. Furthermore, even in big cities, we need complementary sustainable energy source such as solar energy to reduce our energy consumption and protect our environment.
The challenge for most scientists at this moment is to optimize efficiency of photovoltaic cells, but for most African populations the main challenge is to find a way to reduce the solar systems cost. Fortunately our country has lot of sunlight everyday all the year, so African researchers concern must be the reduction of production cost.
Thin film perovskite solar cell could be a solution. At present, it is one of the cheapest technologies because it use cheap organic material and it can be fabricated in a cheap environment compared to crystalline silicon technologies. The best way to reduce the system cost in the future is to fabricate solar cells here in Africa, so we need to start research here with our own specific objectives now.
In this work we will present how we can fabricate low cost perovskite solar cells.

Keywords Solar energy, thin film solar cell, Perovskite solar cells

Acknowledgements: The Fulbright Scholarship for financial support, the University of Delaware and the University Nangui Abrogoua

-**References**

1. Fang Rui *et al*, Sci China Tech Sci July (2016)
2. A. Kojima *et al* J. Am. Chem. Soc. (2009)



Dr Ahoutou Paul Kouakou has a Master and PhD degrees in plasma physics from Lorraine University in France. Since 2009 he's Assistant Professor at University Nangui Abrogoua. During his PhD thesis, Dr Ahoutou used to work on carbon nitride thin films deposited by CVD and PVD plasma. In 2016 he decided to reorient his research topic toward on a local concern, energy. So, he applied and got the prestigious Fulbright scholarship and went in USA for 9 months to work on a cheap solar energy solution for Africa, the Perovskite based solar cells. Back to his home country, he is trying to implement this promising technology. Email: ahoutoupaul@gmail.com

Solution for the optimisation of solar dryer collector

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We present at first a collector for drying cocoa fermented beans having an variable angle and height. The impact of these two elements on the thermal efficiency are analysis and result

show optimum drying condition at 15° and 20cm of elevation from the floor. The homogeneous values of the temperature in the width of the collector measured during the good performance, indicates a negative impact of the bad circulation of the air in the collector. In the second part we present impact of using of natural black colour on absorber on temperature upgrade.

Keywords cocoa, drying, heat, collector

References

1.**Koffi, A.S., NGoran Yao, G.O., Ouattara, H.G., Bruneau, D., Konan, K., Diby, K.A.,«** Analysis of the performance of a newly designed fermenter built in local materials for improvement of cocoa fermentation, in Ivory Coast », *J. Appl. Biosci. 129, 13708–13117, 2018.*

2.**Koffi, A.S., Yao, N., Konan, K., Bruneau, D., Traore, A., Diby, K.A., Saraka, J.K., 2018.** «A numerical model of cocoa beans drying kinetics in an indirect solar and air crossing dryer ». *Int. J. Innov. Appl. Stud. 23, 717–731.*



Aka Stéphane Koffi is an Ivorian. He was a PhD student in Laboratory of Physics of Condensed Matter and Technology. He is working on the application of solar to agriculture. He made several doctoral internships in France in the laboratory TREFLE To improve his knowledge on the drying. I work at present on the cocoa equipment for fermentation and drying. Email: xastinaka@gmail.com

Design, realization and cooking test of a spherical concentrator solar cooker

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We are involved in the study of solar cookers since several years. Some of those studies were about solar box types [1], conical solar cookers [2] or ellipsoidal concentrator solar cookers [3]. The paper reports preliminary cooking tests of a spherical concentrator solar cooker. The basis of the design is given. The concentrator was realized in galvanized steel sheet with an opening diameter of 1.3 m and divided into 12 facets. The concentrator reflective surface was coated with mirror cut in square pieces whose dimensions are: 0.03 x 0.03 m². The spherical concentrator has a focal length f = 0.65 m. A manual tracking system allows the orientation of the reflector in front of the sun. The paper reports a cooking test of three (03) eggs in 0.5 L of water using a black painted pan. Temperature data were recorded at time interval of five minutes, using platinum resistance thermometers. An Appley-type pyranometer was used to record global solar radiation. After 25 minutes of cooking, the three eggs were perfectly cooked.

-Keywords: Solar cooker; spherical concentrator; solar radiation; back axial distance

-**References**

[1] Touré S, Sidibé M, Fassinou W, Gbané A and Samami H 2004. *A performance study of two solar cookers experimented in Abidjan (Ivory Coast).* World Renewable Energy Congress VIII (Denver Colorado, USA, August 29-September 2004)

[2] Touré S and Sidibé M 2017. *Design and evaluation of a conical solar cooker in glazed and non-glazed configurations: cooking tests.* IOP Conf Ser; Earth and Environ. Sci. 93 012011
[3] Touré S and Sidibé M 2018. *Design, realization and experimentation of a solar cooker fitted with an ellipsoidal concentrator. Preliminary results of cooking tests*. IOP Conf Ser; Earth and Environ. Sci. 188 012042



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Realization of a low energy consumption solar medical refrigerator adapted for poor-areas in electricity

Adingra Paul Arsène KOUASSI* and Siaka TOURE

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The mechanical compression solar refrigerator, considered as a machine with high consumption of electrical energy, can be a development asset for the countries where the solar resource is highly available. However, an action to reduce energy consumption and the cost of installation of this machine would allow a large part of the population to benefit from it. The application of this machine to the conservation of vaccines and derived products in health centers is a very delicate and difficult exercise to carry out, knowing the rigorous conditions for the maintenance of the cold chain. At the level of developing countries, the lack of adequate equipment for the storage of vaccines and drugs undermines the different vaccination programs and increases the mortality rate due to the lack of these medical products in health facilities[1,2]. Face with the requirements that govern the vaccines conservation, we have realized a new prototype of mechanical compression solar refrigerator with low electric energy consumption, able to operate regularly throughout the year whatever the meteorological conditions.
In this work, we dimensioned and build a refrigerator of 150 liters with three compartments and an inner cold battery whose energy source is sun. This cold battery of 26-liters capacity thus created allowed not only to lower the inner cooling temperature of vaccines but also to maintain it for more than six and a half days between 2°C and 8°C, according to the prescriptions of WHO, without contribution of electric energy to the motor-compressor. The good thermal inertia of the compartments, with an average refrigeration temperature of 3.2°C, caused by the cooling of the water in the cold battery, reduced the daily operating duration of the compressor at 10 $h.d^{-1}$, thus permitting to reduce the daily energy

consumption of the solar refrigerator from 59 to 34 Ah.d^{-1}. The cold storage by latent heat in a phase change material is an alternative to reduce the energy consumption of solar refrigerators but also to overcome the problems of variations in solar photovoltaic energy.

Keywords
Photovoltaic generator - Energy consumption – Cold storage – Energy gain – Mechanical compression refrigerator – Solar energy

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References
[1]D.O. Simba, G.I. Msamanga, Use of cold chain to assess vaccine exposure to adverse temperatures in rural Tanzania, *East African Medical Journal,* 71(7): 445-446 (1994).
[2]K. Hanjeet et al, Evaluation de la surveillance de la chaîne du froid dans l'Etat du Kelantan-Malaisie, *Bulletin de l'Organisation Mondiale de la Santé* 74, 391-397 (1996).



Mr. Adingra Paul Arsène KOUASSI, PhD student at the Training and Research Unit in Sciences of Structures ,Matter and Technology of Félix Houphouët Boigny University Abidjan-Côte d'Ivoire. After the Master 1 of physic in electrical system and electronics (2007), we have integrated the solar energy laboratory into the solar photovoltaic energy research team after which we obtained the Master. Thesis research are worn on the design and construction of a low electric energy consumption solar refrigerator, with cold storage, to conserve vaccines and drugs. This research project allowed us to participate in several international and national symposiums. Contact: debouegla@yahoo.fr

Characterization of natural dye extracted from Rauvolvia vomitoria for dye- sensitized solar cells:

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Organic solar cells attracted much attention for their huge potential, such as low cost, flexibility and renewable energy conversion devices. Our study is focused on natural dyes extracted from *Rauvolvia Vomitoria* seeds. We extracted dyes using solvent- solvent method and chromatography methods for purification. The characterization was performed by cyclic voltammetry (CV) in anhydrous acetonitrile with TBABF4. Furthermore, UV-Vis spectroscopy studies of light absorption of the natural dye were done. The energy levels have been estimated as at **4.98 eV** for the HOMO energy and **2.56 eV** for the LUMO energy. The new dye can potentially be used in DSCCS structure.

Keywords: renewable energy, DSCCS, CV, LUMO, HOMO.

References

[1] O'Regan, B. & Grätzel, M. A low-cost, high-efficiency solar cell based on dye-sensitized colloidal TiO2 films. *Nature* **353,** 737–740 (1991).

[2] Meredith, P., Bettinger, C. J., Irimia-Vladu, M., Mostert, A. B. & Schwenn, P. E. Electronic and optoelectronic materials and devices inspired by nature. *Reports on Progress in Physics* **76**, 034501 (2013)

[3] Chang, H. *et al.* Characterization of natural dye extracted from wormwood and purple cabbage for dye-sensitized solar cells. *International Journal of Photoenergy* **2013,** (2013).



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Comparaison et analyse des performances d'un moteur diesel fonctionnant à l'huile de jatropha préchauffée et au gazole

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Il est établi que les huiles végétales sont de bons carburants potentiels pour les moteurs diesel (caractéristiques physico-chimiques proches du gazole)[1,2]. Dans ce sens, leur utilisation est une alternative de substitution des sources d'énergies fossiles pour certaines applications. Ce travail a porté sur la comparaison des performances d'un moteur diesel de type LISTER à injection indirecte fonctionnant au gazole et à l'huile pure de jatropha préchauffée ou non. Ce type de moteur est assez répandu en Afrique, plus précisément en milieu rural et sert pour la production agricole, la transformation des produits de récolte, la production d'électricité etc[3]. L'utilisation des huiles végétales pures dans ce moteur engendre certains problèmes de fonctionnement, surtout aux faibles charges (dépôt charbonneux sur la mécanique du moteur, des baisses de puissance et de rendement etc.)[2,3]. Cela est attribué en général aux mauvaises conditions thermiques dans la chambre de combustion et d'atomisation et de granulométrie du jet d'huile[1,2]. Ainsi, pour pallier ces difficultés, l'huile pure de jatropha a été préchauffée à la température de 100°C et la pression d'injection de l'huile a été portée à 170 bars au lieu de 130 bars (réglage d'origine). Pour le gazole, aucune modification n'a été apportée au moteur. Ainsi, trois carburants ont été testés ; à savoir le gazole, l'huile de jatropha sans modification et l'huile de jatropha préchauffée et injecté avec une pression de 170 bars. Pour la comparaison, 3 charges ont été utilisées, elles correspondent respectivement à 13% (450W), 26% (900W) et 43% (1500W) de la charge nominale du moteur. Les résultats obtenus montrent une surconsommation de l'ordre de 15% de l'huile préchauffée comparativement au gazole à 450W de charge du moteur, 12% à 900W et 6% à 1500W de charge du moteur tandis que pour l'huile non préchauffée et sans modifications du moteur, les surconsommations sont de l'ordre de 16 à 20 % pour les 3 charges testées. Quant aux rendements thermiques, elles sont similaires pour le gazole et l'huile préchauffée. Les températures d'échappement et les délais d'inflammation sont

sensiblement les mêmes pour les trois carburants. La dispersion cyclique est faible quel que soit le carburant car les valeurs du coefficient de variation de la pression moyenne indiquée (COV_{IMEP}) sont inférieurs à 10%[4]. Toutefois, les valeurs de COV_{IMEP} les plus élevées sont obtenues à 450W de charge du moteur pour les trois carburants. La plus grande dispersion cycle est obtenue avec l'huile pure de jatropha non préchauffée pour les 3 charges du moteur (les valeurs de COV_{IMEP} à l'huile non préchauffée sont les plus élevées). Les courbes de la pression du cylindre et de la pression d'injection sont comparables pour l'ensemble des carburants. Il ressort que le préchauffage de l'huile et l'augmentation de la pression d'injection permettent de réduire la surconsommation de l'huile de jatropha et d'améliorer les autres performances du moteur.

Mots clés: Huile de jatropha; préchauffage; Moteur Diesel; Pression d'injection, Dispersion cyclique.

Références bibliographiques:

1. **Daho T, Vaitilingom G, Ouiminga SK, et al.** Influence of engine load and fuel droplet size on performance of a CI engine fueled with cottonseed oil and its blends with diesel fuel. *Appl Energy*. 2013;111:1046-1053. doi:10.1016/j.apenergy.2013.05.059
2. **Agarwal D, Agarwal AK.** Performance and emissions characteristics of Jatropha oil (preheated and blends) in a direct injection compression ignition engine. *Appl Therm Eng*. 2007;27(13):2314-2323. doi:10.1016/j.applthermaleng.2007.01.009
3. **Basinger M, Reding T, Williams C, Lackner KS, Modi V.** Compression ignition engine modifications for straight plant oil fueling in remote contexts: Modification design and short-run testing. *Fuel*. 2010;89(10):2925-2938. doi:10.1016/j.fuel.2010.04.028
4. **Heywood JB**. *Internal Combustion Engine Fundementals*. Vol 21.; 1988. doi:10987654

Aluminum-doped zinc oxide films deposited by sol-gel via spray coating technique

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Nowadays, much attention is paid to zinc oxide doping as a promising alternative window layer for thin film based photovoltaic devices because it exhibits outstanding desirable properties such as its non-toxic, abundant, inexpensive and ideal direct bandgap of 3.37eV. In this study, nanostructured aluminum-doped zinc oxide samples used in CIGS thin film solar cells were synthesized through sol-gel via spray coating technique. The as-grown samples were investigated using SEM, XRD, and UV/VIS/NIR spectroscopy techniques. The SEM images show spherical particles that form elongated and connected domains. XRD measurements indicate a typical wurtzite textured (002) structure and reveal an increase in average grain size from 36.3 nm to 41.2 nm in samples. The resulting AZO thin films textured (002) depend on the aluminum content. All the coated films have a high optical quality with transmission in the visible larger 85% and the optical band gap increased from 3.321 to 3.334 eV with Al doping. These AZO coated layers are suitable for CIGS thin film solar cells.

Keywords Spray coating technique, coated AZO, high texture and optical transmission

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References

[1] D H Kim, J-H Park, T I Lee and J-M Myoung *Sol. Energy Mater. Sol. Cells* **65** 150 (2015)
[2] X Wang, Y Zhang, X Chen, M He, C Liu, Y Yin, X Zou and S Li *Nanoscale* **6** 12009 (2014)
[3] N Winkler, S Edinger, W Kautek and T Dimopoulos *Journal of Materials Science* **53** (7) 5159 (2018)
[4] B J Babu, A Maldonado, S Velumani, R Asomoza *Materials Science and Engineering B* **174** 31 (2010)



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External Quantum Efficiency of a ZnO / CdTe Solar Cell: Effects of Space Charge Zones, Diffusion Length & Recombination Rate, Calculated by the Dielectric Function Method

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The quantum efficiency of the ZnO / CdTe solar cell is studied by a simulation through this article. Thus, for the calculation of this efficiency, the absorption coefficients of the two semiconductors are used. Their expressions are given by the dielectric function ε. The effect of space charge area thicknesses, diffusion length and recombination rate explain the appearance of the quantum efficiency of the ZnO / CdTe solar cell. This allows us the different values that must be given, in order to optimize our solar cell.

Keywords: Heterojunction-Zinc Oxide-Cadmium Telluride- Quantum Efficiency-Space Charge Area -Diffusion Length - Recombination Rate

References:

[1] O.A. Niasse, B. Mbengue, B. BA, A. Ndiaye, I. Youm, *Effets of excite on the quantum efficiency of the solar cell CdS/CdTe by the model of the dielectric function*, Review of Renewable Energies. vol. 12 n. 3, 2009, pp. 501 – 512.
[2] S. Z. Karazhanov, Y. Zhang, A .Mascarenhas, S. Deb, The effect of excitons on CdTe Solar Cells, Journal of Applied Physics, vol. 87, n. 12, 2000, pp. 8786-8792.
[3] J. G. Lu, Y. Z. Zhang, Z. Z. Ye, Y. J. Zeng, H. P. He, L. P. Zhu, J. Y. Huang, L. Wang, J. Yuan, B. H. Zhao, and X. H. Li, *"Control of p- and n-type conductivities in Li-doped ZnO thin films*", Appl. Phys. Lett. 89, 112 113 (2006).
[4] M. Diagne, N. Mbengue, M. Niane, O.A. Niasse, B. Ba. *External Quantum Efficiency of a Solar Cell ZnO/Cdte: Effect of Emitter and Base Thicknesses* International Journal of

Engineering Trends and Technology (IJETT) – Volume 20 Number 2 – Feb 2015, pp. 105-108.



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Gestion optimale de l'alimentation d'un moteur dual-fuel couplé à une installation de gazéification de type batch

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Ce poster est une présentation des activités et des acquis d'une thèse débutée en fin 2017. Cette thèse, est une composante d'un projet dénommé: ***GasCal – Contribution à la satisfaction des besoins énergétiques en milieu rural par gazéification des résidus agricoles.*** L'objectif global du projet ***GasCal*** est de contribuer durablement au développement de la production d'énergie décentralisée de faible puissance unitaire basée sur la gazéification des résidus agricoles en milieu rural au Burkina Faso.

Le but de cette présentation est de décrire la démarche et les principales activités prévues dans le cadre de la thèse ainsi que celles réalisées et les principaux acquis. Un banc moteur conçu pour la partie expérimentale est en cour d'instrumentation. Les essais se feront d'abord avec un gaz de synthèse et par la suite avec du syngas.

La partie expérimentale sera soutenue par de la modélisation et des simulations des propriétés de combustion du gaz produit par le réacteur batch et de l'apport théorique nécessaire en diesel pour le brûler.

Le délai d'ignition et la vitesse de flamme ont été simulés grâce au logiciel OpenSMOKE. Ces simulations renseignent sur les propriétés d'auto-inflammation et la propagation du front de flamme dans le mélange syngas-air. Les résultats obtenus montrent un bon accord avec la littérature.

La pression cylindre, la température, la composition du gaz et la richesse du mélange influent sur le délai d'allumage et la vitesse de la flamme. La formation et la propagation de la flamme restent difficiles lorsque la richesse est faible ou lorsque le gaz contient de l'eau.

Mots Clés **:** Moteur diesel; Syngas; Dual-fuel; Délai d'ignition; Vitesse de flamme.

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Ali Diané est ingénieur de recherche en énergie et énergies renouvelables de l'Institut du Génie de l'Environnement et du Développement Durable (IGEDD) de l'Université Ouaga I Pr Joseph KI-ZERBO (Burkina Faso). Dans le cadre de sa thèse, il travaille sur développement durable de la production d'énergie décentralisée de faible puissance unitaire basée sur la gazéification des résidus et sous-produits agricoles en milieu rural en Afrique de l'ouest. Il s'agit plus précisément de la gestion optimale de l'alimentation d'un moteur dual-fuel couplé à une installation de gazéification de type batch. Financée par l'Académie de Recherche et d'Enseignement Supérieur (ARES) de la Belgique, sa thèse est en cotutelle entre l'Université Ouaga I du Burkina Faso et l'Université Catholique de Louvain de la Belgique. Un banc expérimental est développé et instrumenté pour effectuer des tests au Burkina Faso sur les exigences de qualité du gaz. Tel: (+226) 74 70 75 17 Email: bassirimade@yahoo.fr

SMALL SCALE SOLAR THERMAL COOKING SYSTEM BY GRAVITY FLOW

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Solar energy from the Sun is free and God's given with enormous thermal heat available for use. This thermal energy utilization demands for an affordable cooking system with an effective heat extraction unit development as an alternative energy source for domestic cooking. This technology that uses heat extraction and heat transfer fluids such as oil requires either the integration of a pump that operates at high temperature for most cooking need or free fall fluid flow system. However, a pump that operates at high temperature may be expensive to construct and acquire, therefore, making the cooking system even more expensive to a local person in Africa.

This paper presents the design, construction and testing of a small scale solar cooking system constructed using locally available materials. Refined sunflower oil has good thermo-physical characteristics for high temperature and was used as heat transfer fluid. Pre heated oil was displaced by gravity and was circulated by gravity flow through the TES cooking system. The oil flow's speed was varied using manually control valves. The performance of the system was evaluated during cooking of selected food, and then tested successfully to prepare different (meals) foods. In addition, the system performance improved on addition of rock pebbles to cooking unit compared to when only oil alone was used in the solar cooking system.

Key words: Gravity Flow, solar cooking System, High temperatures, Pebbles, Small scale



My name is **Chaciga Jimmy** (Msc. Physics , Makerere University), am ANSOLER in Uganda, I love to do anything possible within my means to develop sustainable alternative energy source for domestic cooking. These little clean energies when used by community worldwide would save our ozone layer. Email; chacigajimmy@gmail.com

Renewable energy accelerator of rural decentralized electrification: case of Côte d'Ivoire

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The first electrifications by extension of network in Ivory Coast were carried out in the years 1960 (fig. 1), with 14 localities out of the 8513 localities which account country. 56 years afterwards, 52% of the villages are still without electricity. The ambition of the government of the Ivory Coast is to electrify all the most important rural areas by 2020. Our thesis, sponsored by the Ivorian Company of Electricity (CIE), aims at making progress the reflection on rural electrification decentralized in order to significantly increase national deposit rate, and the universal access to the electrical energy of the populations which live in the not yet served zones with very short terms. It will be a question for us of working out tools of decision-making aid integrating renewables energies of sources like factor of acceleration of rural electrification.

The decentralized solutions are more increasingly profitable [1] that solutions of networks inter-connected for the villages far away from the domestic network with great discrepancies between the localities and a low population density.

The decentralized systems, as solutions with the access to electrical energy, allow the satisfaction of the energy needs of the rural communities, without the electric sector not supporting the high costs of network connection national. However, it remains of course that according to the importance of the density of the rural populations and the concentration of the villages around a core, pole local development potential, that it is advisable to carry out decentralized mini-networks [2]. This model is based on good progresses in the field of renewable energies of sources (EnR), as well on the level of the production as of the distribution of electrical energy. It is articulated around 3 principal components :

- Relevant and exhaustive identification of the basic needs for the populations alive in the localities not electrified to adapt the model of decentralized electrification.
- The cartography of the resources and the renewable energy arisings allowing to bring specific solutions adapted to each locality (hybridization or mixed energy)

- The alignment of the decentralized system of production and energy distribution to the renewable resources available locally (solar, biomass, wind, hydrolienne, pico-hydraulics…).

Keywords: Rural decentralized electrification, access to electricity, energy of renewable sources

References

[1] Abdou DIOP, 2015, Politiques régionale de la CEDEAO: Énergies renouvelables – Efficacité énergétique, Atelier du 14 au 18 Avril, Paris, 12p
[2] Allet, M. (2016), L'accès à l'énergie par la microfinance en Afrique : une approche partenariale,…



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Realization of remote WebSIG of photovoltaic micro-networks in Conakry (Guinea)

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In Conakry, Guinea, the development of solar energy is still in an embryonic state. With this in mind, the popularization of photovoltaic energy seems to be the right alternative to sustainably improve access to electricity for residents of Conakry. This study proposes to provide a solution to the energy deficit of the population of Conakry. It aims to implement a Web GIS remote monitoring of photovoltaic micro-networks using low speed mobile GSM / GPRS networks to centralize the data collected. The tools used for this purpose in particular are the PostgreSQL / PostGIS couple, the Apache server, the free QGIS GIS software, the LizMap cartographic servers and web portal, the Win `Design software, etc. have effectively controlled the photovoltaic stations. It also aims at making thematic maps relating to the sun, the stock and the energy consumption, as well as the shedding statistics and finally to understand the causes of their dysfunction so as to remedy them by taking effective corrective or preventative measures to contain the anomalies.

-Keywords Photovoltaic energy, Web GIS, Webmapping, Conakry, Guinea.

-**References**
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Remote sensing spectroscopy applied to environmental assessment

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In this work, we proposed a decision support tool base on remote sensing spectroscopy to assess the atmosphere contents and characterize insects. Two telescopes were used in SCHEIMPFLUP configuration. One two expand a near-infrared laser with a modulated frequency in the range of 3.5 kHz and a CMOS line camera connected to the second one to record the backscatter signal. In situ measurements was done on insects in free flying. The signal was analysis in time domain to access to insect's wingbeat frequency. The results show that mosquitoes are nocturnal. There is a large among of mosquito's activities between 18 O'clock and 22 O'clock. This density decreases during the night and increase again around 5 O'clock to 6 O'clock. At these times, insecticide can be applied efficiently.

***Keywords**: Lidar, entomology, time-domain analysis, disease vectors.*

References

1. Anna Runemark, et al., *Rare events in remote dark-field spectroscopy : an ecological case study of insects.* Journal of Selected Topics in Quantum Electronics, 2012. **18**(5): p. 1573-1582.
2. Brydegaard, M., *New mobile observatory for aero-fauna studies.* SPIE Newsroom, 2015.
3. Brydegaard, M., *Aspects of Optical Broad Band Spectroscopy and Information Extraction - Applications in Medicine and Ecology.* 2012, Doktoral thesis, Lund University.
4. Brydegaard, M., et al., *Daily Evolution of the Insect Biomass Spectrum in an Agricultural Landscape Accessed with Lidar.* ILRC27, 2015.



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Électrification solaire réseau, hors réseau et rurale

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L'énergie propre, hors réseau et décentralisée est enfin reconnue comme une alternative financièrement viable pour alimenter les régions isolées en électricité. Pour parler d'accès universel d'ici à 2030, il faudrait fournir un accès à l'électricité à 1,3 milliard de personnes, dont 621 millions se trouvent dans la région subsaharienne.
La baisse rapide des coûts des technologies des énergies renouvelables dont le solaire photovoltaïque rendent ces dernières compétitives sur le marché. Ces choix permettent de donner accès à l'électricité à la majeure partie de la population, de créer des emplois, d'améliorer la qualité de l'air et de limiter le réchauffement climatique. L'importance du défi nécessite que toutes les approches, y compris les solutions réseau et hors réseau, soient prises en compte et adoptés en fonction de la pertinence nationale et des principes d'efficacité. Pour ce faire, il est nécessaire de donner aux pays africains les capacités financières, techniques et institutionnelles pour agir.

Mots Clés électricité photovoltaïque, réseau électrique, hors-réseau, autoconsommation, taux d'accès.

-**Références**

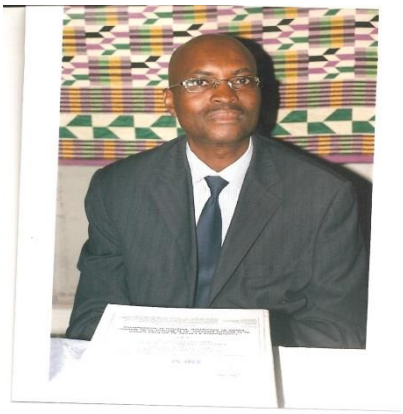
- Numerical simulation of varied buffer layer of solar cells based on CIGS. Sampson Oladapo OYEDELE and Boko AKA, in "Modeling and Numerical Simulation of Material Science, (2017) 33–45"
- Optimisation des paramètres photovoltaïques du CIGS à l'aide du simulateur AMPS-1D. by Sampson Oladapo OYEDELE and Boko AKA, in « Afrique SCIENCE, Vol. 13, N°2 (2017) 274 – 283 »

- Numerical Simulation And Performance Optimization Of Cu(In,Ga) Se2 Solar Cells. by Sampson Oladapo OYEDELE, Bernabé MARÍ SOUCASE and Boko AKA

IOSR Journal of Applied Physics (IOSR-JAP), Vol. 8, N°4 (2016) 01 – 11

- Energy production and financial analysis of photovoltaic energy plants in Ivory Coast. by Inmaculada GUAITA-PRADAS, Bernabé MARÍ SOUCASE and Boko AKA,

Afrique SCIENCE, Vol. 11, N°2 (2015) 24 – 34, www.afriquescience.info



Educational Curriculum

1984 : Maîtrise ès Sciences Physiques, Université de Cocody / Abidjan, Côte d'Ivoire

1985 : DEA (Master) de Physique, option Energétique, Université de Strasbourg 1, France

1989 : Thèse de Doctorat (ph D) en Physique de l'Université de Strasbourg 1, France. Spécialité : Energie solaire photovoltaïque

Professional Experience

1989 : Assistant au Département des Sciences et Technologie de l'École Normale Supérieure (ENS) d'Abidjan

1992 : Maître-Assistant au Département des Sciences et Technologie de l'École Normale Supérieure (ENS) d'Abidjan

1997 - 2000 : Chef du Département des Sciences et Technologie de l'ENS d'Abidjan

2002 : Maître de Conférences au Département des Sciences et Technologie de l'École Normale Supérieure (ENS) d'Abidjan

2008 : Affecté à l'Université Nangui Abrogoua, Abidjan

Biographies of other participants



Professor Abdelfattah BARHDADI is a physicist actively working on semiconductors and their applications in photovoltaic technologies. He has more than 33 years experience in this applied physics field in which he has developed a very high capacity and skills. Since 1995, he is full Professor at the physics department of Ecole Normale Supérieure, Mohammed V University in Rabat. He is also Director of a research structure on semiconductor physics and solar energy (PSES Research Team) and holds several academic responsibilities at national and international scientific institutions as well as at prestigious scientific organizations and distinguished research structures. He is also an international expert in photovoltaic, author/co-author of more than 60 scientific publications, 35 scientific chapters and research reports, and 85 scientific communications including many invited plenary/thematic conferences at international scientific events. He has directed more than 40 theses, dissertations and essays. He has provided his expertise as a scientific evaluator or referee in more than 100 research works, scientific reports and conference proceedings. He is also co-editor of specialized scientific journals, manager of several funded research projects, co-organizer of numerous scientific events, and initiator/co-founder of 9 national and international scientific skills networks and clusters. Professor BARHDADI is a co-founder of the African Network for Solar Energy (ANSOLE). He is also the Moroccan Coordinator and the Vice-Regional Representative in North Africa of this network. Email: abdelfettah.barhdadi@um5.ac.ma / abarhdadi@yahoo.fr



Jean-Pierre Justin Kaam Kouam received his Baccalauréat Technique in refrigeration and air conditionning in 2001 from G.T.H.S Bamenda,his University degree of technology in Thermal and energy engineering at university institute of Technology of Ngaoundere University in 2005,his Technology Bachelor degree in energy saving and environnement at university institute of Technology of Douala University in 2010,his professonnal master degree in maintenance and management of cooling and thermal sytems at the national school of agro industrial sciences of Ngaoundere university in 2015.He started hi professionnal experience since 2000 in cameroon respectively as a technician,deputy head of technical studies,maintenance supervisor,SHE supervisor,project manager in various companies in Douala and Yaounde.From 2010 to 2015, he moves to Gabon where he worked for BOUYGUES as cost estimation engineer for mechanical,heating,ventilation,air conditionning and projects.Since 2015, he has been working for BOUYGUES in Abidjan as tendering and cost estimation manager for mechanical(heating,ventilation,air conditionning) and electrical projects. He is an active ANSOLE member since September 2018
He speaks 3 languages, is married and father of 4 children. Contact: jpkouam2003@yahoo.fr



Sampson Olapodo Oyedele a obtenu son doctorat en physique en 2017 spécialité énergie solaire. Il est membre associé à l IREN, Abidjan et membre d ANSOLE. Email: oyesamson2000@gmail.com



Dr FASSINOU Wanignon Ferdinand, Maître de conférences, est diplômé de l'Université Félix HOUPHOUËT-BOIGNY d'Abidjan -Cocody par l'obtention d'un doctorat d'état es sciences physique spécialité énergétique et environnement en 2015 après un doctorat de 3ème cycle de la même université obtenu en 1997 avec la spécialité énergie solaire. Il a été pos-doctorant (2004-2005) et chercheur (2012) au Centre International de Recherche Agronomique pour le Développement (CIRAD) de Montpellier-France où il a travaillé sur la pyrolyse et la gazéification de la biomasse.

Depuis 1998 il a été engagé comme enseignant-chercheur de physique à l'université Félix Houphouët-Boigny d'Abidjan-Cocody (Côte d'Ivoire). Il est aujourd'hui Maître de Conférences (CAMES) dans la même université où il mène ses activité d'enseignement et de recherche dans le domaine de l'énergie solaire photovoltaïque, le solaire thermique, la valorisation énergétique de la biomasse (pyrolyse-gazéification,...) et sur les biocarburants. Il participe actuellement au projet AFREQEN ERAMUS + " qualité en enseignement supérieur pour les énergies renouvelables en Afrique du Nord et de l'Ouest". Email: faswaniferd@yahoo.fr / faswaniferd@caramail.com

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39	Olga Brou N´Guessan	Côte d´Ivoire	

Rapport/ ASMCI 2018

Le 10 novembre 2018, s'est tenue à l'Université Félix Houphouët-Boigny à Abidjan, Côte d'Ivoire, une rencontre scientifique internationale intitulée "ANSOLE Scientific Meeting in Côte d'Ivoire (ASMCI 2018)", organisée par ANSOLE. Les travaux qui se sont déroulés dans la salle INFO 1 du laboratoire de Physique de la Matière et de Technologie (LPMCT) de l'UFR Sciences des Structures de la Matière et de Technologie (UFR SSMT) de 14h à 20h ont vu la participation de 42 personnes venues de différents pays: Autriche/Allemagne, Burkina Faso, Côte d'Ivoire, France et Maroc.

Cette rencontre s'est déroulée en deux phases: les cérémonies d'ouverture et de clôture et l'atelier de présentation de travaux scientifiques en deux panels. Une pause-café offerte par l'équipe Energie et Innovation Technologique (EnIT) de Dr N'GORAN Yao, LOC Coordinator of ASMCI 2018 a eu lieu entre les deux panels. D autre part l atelier a reçu la visite du Mr Séverin AKÉ, chef du Service Recherche Valorisation Innovation (UFHB_VPRIT_SRVI) au Pôle Scientifique et d´Innovation (PSI) de l université de Cocody, qui a exprimé sa satisfaction de voir la tenue de l atelier.

1/ Cérémonies d'ouverture et de clôture

La cérémonie d'ouverture a été marquée par quatre allocutions.

La première prononcée par Dr N'GORAN Yao, en tant que coordinateur du Comité d'Organisation Local de la rencontre. Il a souhaité la bienvenue aux participants et remercié le décanat pour l'acceptation de la tenue de cette rencontre ainsi que le coordonnateur international d´ ANSOLE pour la confiance qu'il lui a faite en lui confiant l'organisation locale de cette rencontre. Il a exprimé sa joie de voir un si grand nombre de participants, car jusqu'à la veille seulement une vingtaine de personnes s'étaient inscrites.

La deuxième intervention est revenue au Professeur ZOUEU Jérémie de l'INP-HB en tant que représentant national de ANSOLE qui a lui aussi souhaité la bienvenue aux participants.

En troisième position, le professeur Daniel Ayuk Mbi EGBE, a exprimé toiute sa joie que cette rencontre aie eu lieu et remercié les participants, les Vices doyens de l'UFR SSMT, le doyen de SFA et particulièrement le coordinateur du Comité d'organisation local, Dr N'GORAN Yao pour son efficacité et son dynamisme. Le Professeur Egbe n a pas manqué

d exprimer sa joie de voir les deux doctorants burkinabés, Ali Diane et Yomi Woro Gounkoua, qui se sont deplacés pour Abidjan et qui ont contribué à donner le flair international de la rencontre.
Enfin, professeur OBROU Olivier, le Vice-doyen en charge de la Recherche au sein de l'UFR SSMT, a procédé à l'ouverture officielle de la rencontre en souhaitant au nom de Monsieur le Doyen de l'UFR SSMT qu'il a représenté la bienvenue aux participants et un bon atelier.
La cérémonie de clôture a été marquée par la rémise des attestations de participation par le Coordonnateur d´ANSOLE et par les mots de clôture de Dr N'GORAN Yao qui a exprimé sa satifaction pour la tenue de l'atelier, du Professeur Daniel Ayuk Mbi EGBE qui, très heureux de voir que l'atelier a atteint ses objectifs, a souhaité que ANSOLE Côte d'Ivoire travaille pour relever les nombreux défis de l'Afrique en matière de promotion d'énergies renouvelables et de professeur OBROU Olivier, Vice doyen de l'UFR SSMT en charge de la recherche pour mettre fin à la cérémonie.
Le Professeur Kre N´GUESSAN, Doyen de l´UFR SFA de l´université Nangui Abrogoua, s est declaré prêt à accueillir la prochaine journée ANSOLE au mois de février 2019.

2/ Atelier de présentation de travaux scientifiques
Plus d'une dizaine de présentations ont traité les quatre thèmes suivants :
1- Gisement solaire
2- Fabrication de cellules photovoltaïques
3- Applications solaires photovoltaïques
4- Applications solaires thermiques

Cet atelier s'est déroulé en deux (2) panels y compris un (1) poster.

Panel 1
Ce premier panel dont le modérateur est J.P.J. KAM KOUAM a enregistré 5 communications qui sont :
Communication 1: Elaboration de matériaux semiconducteurs en couches minces par des techniques à bas coût pour applications en photovoltaïque et capteurs de gaz par **B. Hartiti**/ FST de Mohammedia, Université Hassan II de Casablanca, Morocco,
Communication 2*:* Solar cell main recombination mechanisms characterization with the temperature-dependent open circuit voltage par **A.Darga** /Paris-Sorbonne Unversity, France
Communication 3*:* Estimation and prediction of the national potential of solar energy par **Y. Ngoran**/ University of Cocody, Abidjan
Communication 4*:* Low cost solar energy, Perovskite solar cell par **A.P. Kouakou**/ University Nangui Abrogoua, Abidjan
Communication 5*:* Design, realization and cooking test of a spherical concentrator solar cooker par **S. Touré/** University of Cocody, Abidjan

Panel 2
Ce deuxième panel dont le modérateur est Prof J. ZOUEU a enregistré 6 communications et 1 poster qui sont:
Communication 6: Solution for the optimisation of solar dryer collector par **A.S. Koffi**/University of Cocody, Abidjan
Communication 7: Realization of a low energy consumption solar medical refrigerator adapted for poor-areas in electricity par **A.P.A. Kouassi**/ University of Cocody, Abidjan
Communication 8: Characterization of natural dye extracted from Rauvolvia vomitoria for dye- sensitized solar cells par **J.K. Datte/** University of Cocody, Abidjan
Communication 9: Comparaisonet analysedes performances d'un moteur diesel fonctionnant à l'huile de jatropha préchauffée et au gazole par **Y. W. GOUNKAOU**/University of Ouaga1 Pr KI-ZERBO, Burkina Faso

Communication 10: Réalisation d'un réfrigérateur médical solaire, à faible consommation d'énergie, adapté pour les régions pauvres en électricité par A. P. A. KOUASSI/University of Cocody, Abidjan

Communication 11: Réalisation d'un WEBSIG de contrôle centralisé à distance de micro-réseaux phpotovoltaïques dans la région de Conakry en Guinée par K. H. KPEGNE/University of Cocody, Abidjan

Poster

Communication 12: Gestion optimale de l'alimentation d'un moteur dual-fuel couplé à une installation de gazéification de type batch par **A. DIANE**/University of Ouaga1 Pr



Joseph KI-ZERBO, Burkina Faso.

Les résumés des communications sont publiés dans ce recueil. Ce dernier est téléchargeable sur le site d´ANSOLE.

Fait à Abidjan, le 20 novembre 2018

Dr Yao N'GORAN, LOC Coordinator of ASMCI 2018

Quelques temps forts d ASMCI 2018 en images



Figure 1:Gauche) Photo de famille prise devant le bâtiment de l'équipe Energie et Innovation Technologique (EnIT) de Dr N'GORAN Yao, LOC Coordinator of ASMCI 2018, Droite) Photo de famille autour de la station météo de l'équipe EnIT





Figure 2: Photos de la salle de l'atelier lors des communications



Figure 3: Photos lors de la pause café





Figure 4: Rémise des attestations de participation





Figure 5: Rémise des attestations de participation (suite)

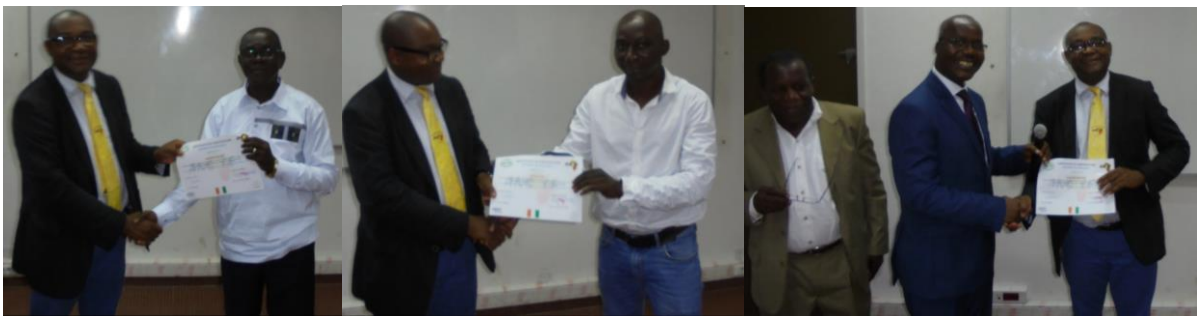


Figure 6: Rémise des attestations de participation (suite et fin)

Save the dates!!!

2nd **ANSOLE Scientific Meeting in Côte d´Ivoire (ASMCI 2019), Université NANGUI ABROGOUA** Route d 'Abobo, Face Entreprise Filtisac, 02 BP 801 Abidjan 02, Côte d'Ivoire, **14 February 2019**

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Submit registration+abstract+ short biography to ***asmci2109@ansole.com*** *latest* ***7 February 2019***

1st **ANSOLE Scientific Meeting in Egypt (ASMEG 2019), Zewail City of Science and Technology**, 6th of October City, Giza, Cairo, Egypt, **13 February 2019**

Submit registration+abstract+ short biography to ***asmeg2019@ansole.com*** *latest* ***6 February 2019***

ANSOLE DAYS 2019, University of Ghana, Accra-Legon, 16-20 September 2019

Trans-disciplinary International Conference on Sustainable Energetics and Health

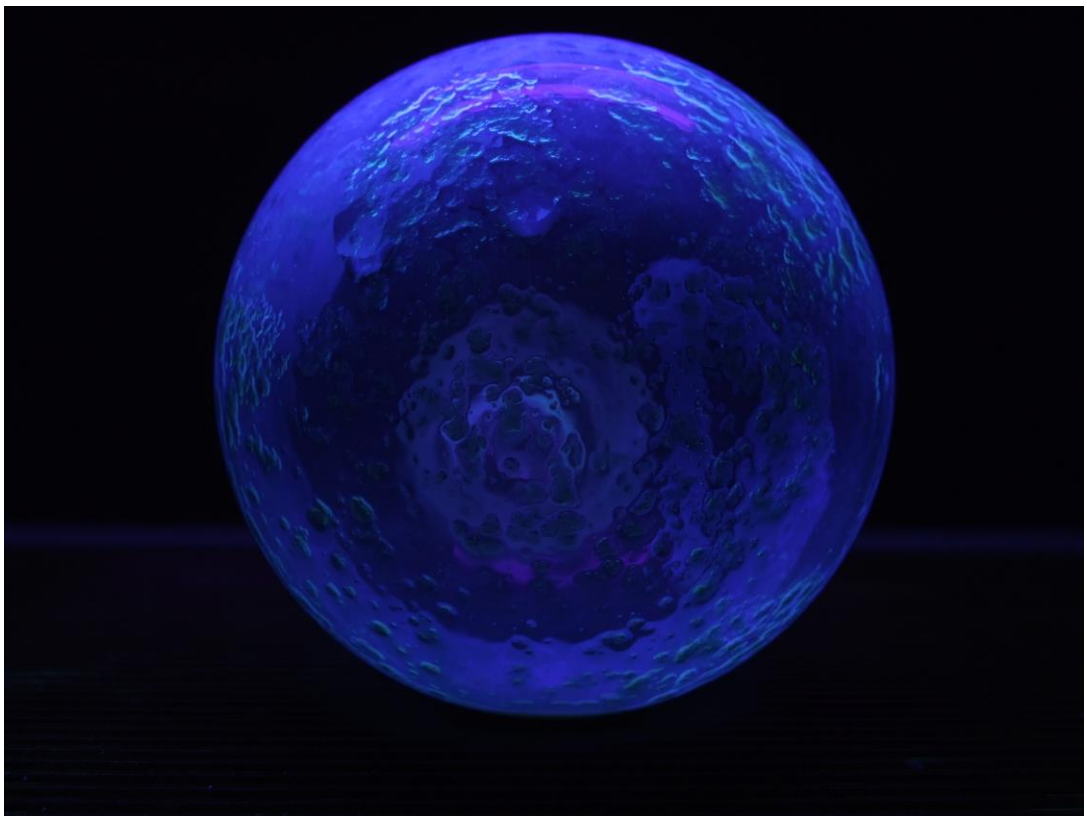


Image from Daniel A.M. Egbe´s research: 1st Prize during 2018 competition on "Wunder der Wissenschaften (Wonders of Sciences)" at the Johannes Kepler University Linz, Austria

https://www.jku.at/news-events/news/detail/news/sichtbare-forschung-siegerfoto-gekuert/