

GDR-NAME Christmas Newsletter

december, 2021



N A M e

GDR Nanomaterials for Energy Applications



EDITO

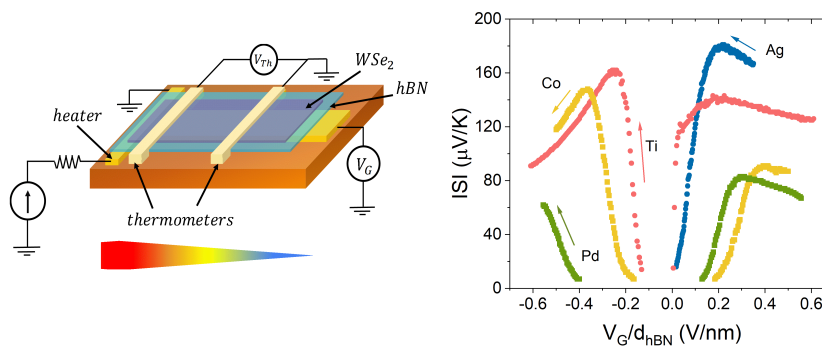
Dear GDR partners

This year was full of nice events even though the Covid is still present. The GDR was able to meet at ESIEE thanks to the local organizers during three days enjoying very fruitful discussions. To close this year, we will wish you a merry christmas and happy new year, with a year 2022 full of nice meetings, scientific exchanges and projects. Lots of important dates are facing us either directly related to the GDR like finishing the White Paper, the next plenary meeting or different workshops and conferences from various communities. As a christmas present, we offer you the picture of dendritic growth of ice from Chartreuse Regional Park ! Seasons's greetings to you and to your relatives !



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IMAGE OF THE MONTH

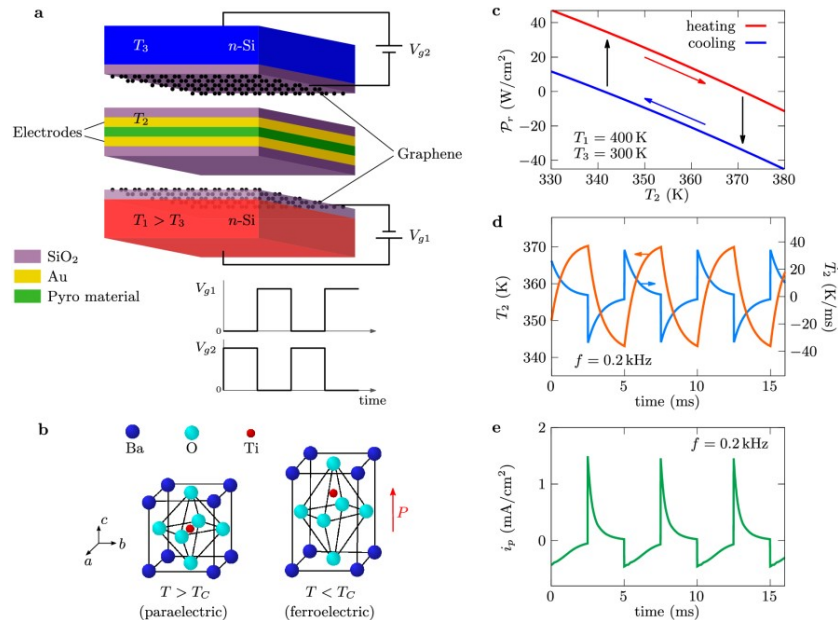


2D materials applied to energy recovery under the spot light !

Low dimensional systems have opened new routes of investigation for thermoelectric energy conversion. In particular, 2D transition metal dichalcogenides appear as promising materials in this domain due to their low thermal conductivities and controllable electronic properties. However, these systems are particularly sensitive to the environment that can strongly modify their intrinsic characteristics. More below !!

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Scientific highlights

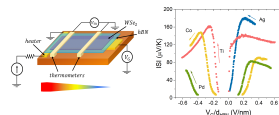


Graphene-based autonomous pyroelectric system for near-field energy conversion

In the close vicinity of a hot solid, at distances smaller than the thermal wavelength, a strong electromagnetic energy density exists because of the presence of evanescent field. Traditionally this radiative energy is extracted by tunneling by approaching at subwavelength distance from this body a PN junction. Although theoretically this technology can lead to a generated power of about 10W cm⁻² with heat sources at $T > 500$ K only generated power densities of few dozens of mW.m⁻² have been reported so far with thermal sources between 500K and 1200K. A novel technology to harvest this energy using graphene-based pyroelectric conversion devices made with an active layer (see figure) encapsulated between two graphene field-effect transistors have been introduced. By tuning the bias voltage applied to the gates of these transistors, the thermal state and the spontaneous polarization of the active layer can be controlled at kHz frequencies. The power density generated by these autonomous conversion systems can reach 130mWcm⁻² using pyroelectric Ericsson cycles, a value which surpasses the current production capacity of near-field thermophotovoltaic conversion devices by more than three orders of magnitude with low grade heat sources ($T < 500$ K) and small temperature differences ($\Delta T \sim 100$ K).

Ivan Latella et Philippe Ben-Abdallah, Scientific Reports **11**, 19489 (2021)

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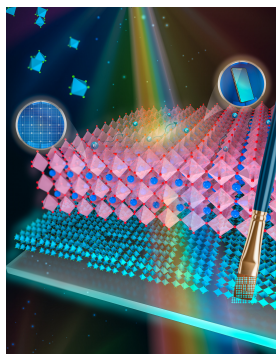


Role of metal contacts on the electric and thermoelectric response of hBN/WSe2 based transistors

This experimental work put the accent on the electric and thermoelectric response of 2D material in practical device when varying the nature of the metallic electrodes. Field effect transistors based on hBN/WSe₂ with different electrode/2D material interfaces realized by Ag, Pd, Co and Ti thin films are investigated by exploring charge injection and the Seebeck coefficient at room temperature. Cobalt electrodes appear as the best solutions to maximize the power factor, revealing the importance of an optimized device engineering in low dimensional system to enhance thermoelectric performances.

Figure caption: (left) Schematics of the hBN/WSe₂ based transistor with electrical connections for thermoelectric measurements. (right) Absolute value of the Seebeck coefficient (S) as a function of the applied gate voltage (V_g) normalized to the dielectric thickness in devices made with different metal electrodes. S. Timpa, M. Rahimi, J. Rastkian, S. Suffit, F. Mallet, P. Lafarge, C. Barraud, M.L. Della Rocca, J. Appl. Phys. **130**, 185102 (2021).

[LINK](#)



Photovoltaic: new alternatives for transparent conductors

In order to extract the electrical charges produced in photovoltaic cells, a transparent electrode to visible light is used, so that the light can reach the photoactive materials. To replace the indium-tin oxide (ITO) currently used, which is too expensive, scientists from CRISMAT and CIMAP (CNRS / Normandie University / ENSICAEN / UNICAEN), ISCR (CNRS / University of Rennes), GEMaC and ILV (CNRS / Université de Versailles Saint-Quentin-en-Yvelines - Université Paris-Saclay), P' (CNRS / Université de Poitiers-ENSMA SP2MI), propose to replace it with transparent conductive oxides based on vanadium perovskite deposited on 2D materials (nanosheets) which have a performance comparable to ITO.

Highly Transparent and Conductive Indium-Free Vanadates Crystallized at Reduced Temperature on Glass Using a 2D Transparent Nanosheet Seed Layer by A. Boileau, S. Hurand, F. Baudouin, U. Lüders, M. Dallochio, B. Bérim, A. Cheikh, A. David, F. Paumier, T. Girardeau, P. Marie, C. Labbé, J. Cardin, D. Aureau, M. Frégnaux, M. Guilloux-Viry, W. Prellier, Y. Dumont, V. Demange, A. Fouchet, Advanced Functional Materials 2021, 2108047. <https://doi.org/10.1002/adfm.202108047>

[LINK](#)

GDR-NAME NEWS

Daily life of the GDR: CSA 2021 closing meeting (13/12/21)

Important points for GDR's life have been discussed during 2 hours meeting:

- 1. Review of 2021 actions** and 2021 financial review (files on the budget are accessible upon request.)
- 2. Actions planned for 2022:** Plenary in Lyon and at least 5 thematic days. Thematic school for 2022: MONACOSTE organized by S. Merabia. We will communicate the exact dates and details asap.
- 3. White Paper:** The majority of the six chapters have been submitted or they will be

submitted soon. The first uniformised draft will be return to the workshop organisers by the end of February, following a cross-reading.

4. Scientific hot topics of the GDR for the group *Miroir of the CNRS*, a list of almost twenty essential subjects of the GDR has been elaborated going from nanophysics to elaboration, measurements and metrology.

5. GDR-NAME road-map Based on the key subjects and the white paper, a road map will be prepared and proposed by the CSA. A meeting with EPICS and industrials on the subject will be organized during March / April 2022.

GDR-NAME Plenary meeting at ESIEE



Plenary of the GDR took place on the 4th to 6th of october 2021

It has been a real pleasure to meet (not virtually) again with all the components of the GDR. The meeting has been organized at ESIEE by Philippe BASSET (ESYCOM), Elyes NEFZAOU (ESYCOM) and Jérôme SAINT-MARTIN (C2N) with close to 100 registered participants. Thanks again to all the organizers !!!

This plenary session was carried out over 4 half-days (1 half-day, full day then 1 half day). The program consisted of invited talks, presentations of the perspectives of the 6 workshops, presentations of the 3 winners of thesis prizes (1 for 2020 and 2 for 2021) and poster sessions.

Here is the list of the 6 guests for this plenary with the title of their presentation: • Jean-Paul KLEIDER, "Photovoltaics today: an overview" • Georges FAVRE, "Landscape of standardization & opportunities to validate methods of nanomaterials characterization " • Christophe COUTANCEAU, "Clean hydrogen production from electron-reforming of oxygenated organic compounds" • Anne TANGUY, "Thermal Transfer at the atomic scale in amorphous / nanostructured samples " • Jean-Marie TARASCON, "Battery materials: What interest for physicists? " The thematic guest was: • Jérémie MAIRE, "Presentation on Thermal Management for 5G"

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White Paper: wrapping up !



Six workshops on related subjects to the Nanomaterials for Energy

We are close to finish the White Paper, we need to assemble all the contributions and build the final version. To come early in 2022 !

We deeply thank all the participants !!

ANNOUNCEMENTS

Events, Conferences, workshop etc...!!!



International Symposium on Electrocatalysis 2022
Sacacomie, Québec, Canada
The World is Embracing Hydrogen April 25 - 28, 2022 (deadline for abstract January 31st, 2022)

In the light of hydrogen being recognized as the fuel of tomorrow and being gradually embraced by the global energy industry, the symposium focuses on all aspects of electrocatalysis, photoelectrocatalysis and sonoelectrocatalysis of hydrogen. It covers both fundamental and applied aspects of hydrogen generation employing electrochemical technologies (e.g., water electrolyzers) from pure, saline and wastewater and its utilization in fuel cells and other electrochemical devices. It also focuses on interfacial phenomena and materials science in relation to hydrogen electrocatalysis and electrochemistry. Special attention is dedicated to the carbon dioxide reduction and nitrogen reduction reactions to value-added products, as the processes involves hydrogen. The Symposium also covers environmental remediation through electrocatalytic, photoelectrocatalytic, and sonoelectrocatalytic valorisation of waste (by-product) chemicals, and any other topics related to the applications of electrocatalysis in clean and environmentally friendly electrochemical technologies.

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Nanoscale and Microscale Heat Transfer, Palermo, ITALY
Deadline for abstract submission 10th of january 2022

The next Eurotherm conference "Nanoscale and Microscale Heat Transfer VII will be held in Palermo in Sicily.

Aims and Scope: It will be the seventh in the series of successful conferences, the last three of which took place in Lyon (2014), Santorini (2016) and Levi (2018). Its main scope is to present the state-of-the-art and the modern trends of nanoscale and microscale heat/energy transfer.

The program features 4 tutorial sessions and 4 plenary sessions led by selected speakers (see below), complemented by contributed oral and poster presentations, covering the full range of topics.

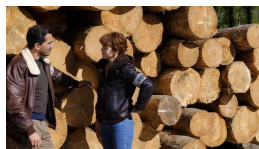
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JNRSE in Bordeaux the 8th of july, book the date !!!!

This year, the IMS Laboratory will organize on Friday July 08, 2022, the 11th edition of the National Days on Energy Recovery and Storage (JNRSE) for autonomous microsystems in Bordeaux. Paper submissions will be possible from early May 2022. The website is being finalized.

Trois idées chartroussines pour passer des fêtes de Noël et nouvel an dans des conditions normales de températures et de pression



Les bois maudits

Le téléfilm policier tourné en Chartreuse en 2021 sera diffusé le soir du 25 décembre, samedi prochain, à 21h sur France 3. Bon aura peut-être mieux à faire, mais il reste en replay !!



Diots au sapin

Les diots sont des saussices dodues de Savoie. Pour cette recette il faut ramasser des jeunes branches de sapin fraîches en Chartreuse, les disposer au fond d'une cocotte, mettre les diots cru, les oignons coupés en dès et les pommes de terre épluchées coupées en dès également dans le panier de la cocotte le tout posé sur les branches de sapin (le panier évite de mettre des aiguilles de pin de partout). Mettre deux ou trois verres de vin blanc sec au fond sur les branches de sapin et hop cuisson pendant 45 min. Les diots prennent le goût de résine de pin, unique !! Attention le fond doit toujours rester humide avec un peu d'eau pour éviter le gout de brûlé...



Green chaud

Préparer un chocolat avec du lait entier et du chocolat noir (de chez Bonnat (Voiron) préférentiellement), puis ajouter un trait de la liqueur verte du massif de la Chartreuse. Vous obtiendrez un Green Chaud très prisé en bas de pistes de ski. A boire avec la modération habituelle que l'on vous connaît.

You have received this email because you have subscribed to the GDR mailing list.

Don't forget to submit your announcements, proposals for highlights, image of the month, information of all types... Thank you!



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