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Mexican Awarded

Mexican Science and Technology Gold Medal 2018 granted by the President of Mexico

Professor Leticia M. Torres-Martínez

SUMMARY

Professor Leticia M. Torres-Martínez received a Doctor degree in Advanced Ceramics Materials from University of Aberdeen, Scotland UK. She is a Certified leader in Applied Renewable Energies and Energetic Efficieny from Harvard University, USA. She has the following scientific, academic and technological products: more than 200 indexed published articles, supervised more than 70 postgraduate theses, 1 authorized patent and 4 registered, 7 chapters book, 3 books, 400 international lectures, 9 proceeding books, 27 innovations and technological developments, 58 research projects; 2,500 citations to her publications. She has been the leader of 5 research groups and 3 national scientific networks, 5 designed and implemented postgraduate programs. Two of these programs were designed and offered as UNI-Enterprise (Vitro and Cemex). She designed and implemented the Center for Research and Development of Ceramic Materials (CIDEMAC), which was self-financed by her leadership. From the year 2009-2012, she led a technological development project with PEMEX, which allowed the pre-boot technology change in their processes.

AREAS OF EXPERTISE

a) Development of advanced materials (powders and thin films) for renewable energy systems and sustainable environmental decontamination.
b) Synthesis, characterization and performance of multifunctional materials on photoinduced processes.
c) Preparation of semiconductor materials for environmental photo(electro)catalysis: H_2 production, CO_2 photoconversion and water purification.
d) Synthesis of new ceramic oxides based on phase equilibrium diagrams.

APPOINTMENTS

- General Director of CIMAV-CONACYT (Center for Research in Advanced Materials – Centro de Investigación en Materiales Avanzados) (2019-2024)
- Head of Ecomaterials and Energy Department (2005- to date).
- Full Professor at Universidad Autónoma de Nuevo León: a) Faculty of Chemistry (1985-2005) and b) Faculty of Civil Engineering (2005- to date).
- Deputy Director of Scientific Development at CONACYT (2011-2013).
- Leader and founder member of the Center of Research and Development of Ceramic Materials (CIDEMAC), which was located in Faculty of Chemistry, in the Universidad Autónoma de Nuevo León. CIDEMAC was nominated as a finalist at the 2000 National Technology Awards convened by the Ministry of the Trade and Industrial Development and the Mexican Republic Presidency.
- Head of Research at Chemistry Department UANL (1995-2001).
- President of Mexican Academy of Materials (2000-2002).
- Leader of several technological projects of National Ceramic Industry.
- Coordinator of homologous national research groups (ceramic materials) in order to carry out different technological projects of the national ceramic industry.
- Leader of the design and establishment of two postgraduate programs (MSc and PhD) in ceramic engineering, which have the recognition of the federal government as an excellent postgraduate program. She has directed more than 60 postgraduate students.
- Leader of the design and implementation of three postgraduate programs offered to large industries specialized in cement and glass: CEMEX, S.A. de C.V., VITRO S.A. de C.V. and Crisa Libbey México, S. de R.L. de C.V.

SYNERGESTIC ACTIVITIES

Prof. Leticia Torres-Martínez, was the leader and founder of the Center of Research and Development of Ceramic Materials (CIDEMAC), located in the Chemistry Department, in the University Autonomous of Nuevo León. This centre was nominated as a finalist at the 2000 National Technology Awards convened by the Ministry of Trade and Industrial Development and the Mexican Presidency. From 1995 to 2001, she was Head of Research at Chemistry Department. From 2000 to 2002 was The President of Mexican Academy of Materials. She designed, structured and implemented two postgraduate programs (MSc and PhD) in ceramic engineering, which has the recognition of the federal government as an excellent or high level postgraduate program. She has designed a similar postgraduate programs offered to two big industries of cement (CEMEX, S.A. de C.V.) and glass (VITRO S.A. de C.V.). She has directed more than 70 postgraduate students and currently directs seven theses. She coordinated during four years homologous national research groups (ceramic materials) in order to carry out different technological projects of the National Ceramic Industry. She was invited in 1999 as Editor for the Special Issue: Inorganic Chemistry in Latin America edited by Polyhedron. In addition, she has contributed with the Journal of Solid State Chemistry as Coordinator in Latin America for the Special Issue on Solid State Science. As Deputy Director of Scientific Development at CONACYT (2011-2013), she implemented initiatives such as national programs in order to promote and support large-scale research projects, focused on the generation of articulated and structured solutions that contribute to the national development of our country. Also, she promoted the National Consortium of Scientific and Technological Information Resources (CONRICYT), which has the mission of strengthening the capacities of Higher Education Institutions and Research Centers by facilitating access to scientific information in digital formats. Currently, as Head of Ecomaterials and Energy Department, promotes the strengthening of the scientific-technological bases of research in the areas of superfunctional materials, the environment and non-renewable and clean alternative energy, to offer integral synergistic solutions to decontamination and environmental prevention, as well as generation of energy, based on modern technologies and emerging internationally. In addition, she promotes the training of human resources through the postgraduate courses in environmental engineering in the Institution and with the collaboration of prestigious national and international researchers. Also, her department offers to the industrial and academic sector, specialized services of characterization and analysis of materials and substances, especially those classified as ceramics: cements, refractories, glass and pigments, among others .

SOME SCIENTIFIC CONTRIBUTIONS

Prof. Leticia Torres-Martínez research leadership is distinguished for developing new materials (in powder and thin films) with semiconductor properties that present a favorable combination of electronic structure and property of absorbing light, in addition to efficiently absorbing reagents, to achieve high efficiencies of photo(electro)catalysts in a) H_2O conversion reactions to produce clean H2 , b) CO2 photoconversion to generate solar-based fuels with carbon content and c) the degradation of organics in water. Her scientific and technical novelty of the current work involves the development and coupling of advanced photocatalysts for their use in photoinduced processes with the objective of obtaining alternative clean and renewable energy sources to avoid the use of fossil fuels. Her group has experience in new phase diagram studies, different synthesis methods, crystallochemistry of materials; electrical, catalytic and photo(electro)catalytic properties. Her research group is one of the few that select materials based on this exhaustive analysis of such diverse parameters in order to establish structural relationships of semiconductors with photoinduced processes, to enhance the efficiencies of some photocatalysts. The methods of fabrication proposed are environmental-friendly and have an appropriate relationship cost-efficiency, allowing the production at higher scale of these materials. The photocatalysts are recyclable: their efficiency is high and stable with the time. For achieving this properties, different innovative strategies had implemented such as the deposition of earth abundant cocatalysts, the formation of heterostructures and the preparation of highly faceted nanostructures films by laser CVD . Films are also prepared by sputtering, inkjet printing, electrochemical and dip coating methods. All these strategies are employed in order to increase the lifetime of the charge carriers, promote the separation of the charges in the interface, and increase the photo(electro)catalytic efficiency. In the search for new materials with high photocatalytic efficiencies, they have developed alternative synthesis methods that make it possible to obtain highly crystalline materials, as well as large surface areas and special micro / nano structures suitable for each particular process. She has led the investigations of two families of materials with the highest efficiencies in the photocatalytic production of hydrogen, in orders of up to 20 times greater than those reported in indexed journals, by other international research groups.

AWARDS AND HONORS

She has more than 67 national and international awards and recognitions, which we highlight: 1) **Mexican Science and Technology Gold Medal 2018**, awarded in Los Pinos by the President of Mexico based on her scientific and technological lifetime contributions on the Field. 2) **Twenty-three Awards for UANL Best Research Work in Exact Sciences and Engineering and Technology areas**. The most recent in 2019, awarded in Exact Sciences. 3) Appointment as a Member of the CONACYT National Evaluation Commission of Engineering Researchers (2017-2019). 4) "Valor Regiomontano URRE" Award for contributions in Nuevo Leon State society (2019), 5) Civic Award for successful scientific contributions in Nuevo Leon State society (2015). 6) Recognition "Flame, Life and Woman" by remarkable career and outstanding work in the field of Education and Research, as part of International Women's Day. UANL, in 2012. 7) Appointment as a Member of the Board and Representative of researchers in the areas VI and VII of SNI in the Technological and Scientific Advisory Forum 2008 to 2011. 8) Nomination of CIDEMAC in the National Award of Technology by SECOFI, it was one of the 3 FINALISTS companies of technology research (out of 180), awarded in Los Pinos and headed by President Ernesto Zedillo Ponce de Leon in 2000.

SELECTED SCIENTIFIC PUBLICATIONS (2010-2020)

1. E. Luévano-Hipólito, Leticia M. torres-Martínez. Dolomite-supported Cu_2O as heterogeneous photocatalysts for solar fuels production. **Materials Science in Semiconductor Processing, Volume 116 (2020) 105119-105127** https://doi.org/10.1016/j.mssp.2020 ISSN: 1369-8001
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3. Carrasco-Jaim, Omar A., Huerta-Flores, Ali M., Leticia M. Torres-Martínez., Moctezuma, Edgar. Fast in-situ photodeposition of Ag and Cu nanoparticles onto $AgTaO_3$ perovskite for an enhanced photocatalytic hydrogen generation. **International Journal of Hydrogen Energy, Volume 45 (2020) 97444-9757** https://doi.org/10.1016/j.ijhydene.2020.01.242 ISSN: **0360-3199.**
4. Luis Ángel Alfonso Herrera, Paola Karen Camarillo Reyes, Ali M. Huerta Flores, Leticia M. Torres-Martínez, José María Rivera Villanueva. BDC-Zn MOF sensitization by MO/MB adsorption for photocatalytic hydrogen evolution under solar Light. **Materials Sciense in Semiconductor Processing, Volume 109 (2020) 104950.** https://doi.org/10.1016/j.mssp.2020.104950 ISSN: 1369-8001
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6. Luis A. Alfonso-Herrera, Ali M. Huerta-Flores, Leticia M. Torres-Martínez, Daniel Julián Ramírez-Herrera, J.M. Rivera-Villanueva. M-008: A stable and reusable metalorganic framework with high crystallinity applied in the photocatalytic hydrogen evolution and the degradation of methyl orange. **Journal of Photochemistry and Photobiology A: Chemistry, Volume 389 (2020) 112240.** https://doi.org/10.1016/j.jphotochem.2019.112240. Luz I. Ibarra-Rodríguez, Ali M. Huerta-Flores, Leticia M. Torres-Martínez. Development of $Na_2Ti_6O_{13}$/CuO/Cu_2O heterostructures for solar photocatalytic production of low-carbon fuels. . **Materials Research Bulletin, Volume 122 (2020) 110679.** https://doi.org/10.1016/j.materresbull.2019.110679 ISSN: 0025-5408
7. M.R. Alfaro-Cruz, D. Sánchez-Martínez, L.M. Torres-Martínez. CuO thin films deposited by DC sputtering and their photocatalytic perfomance under simulated sunlight. **Materials Research Bulletin, Volume 122 (2020) 110678** https://doi.org/10.1016/j.materresbull.2019.110678 ISSN: 0025-5408
8. Luz I. Ibarra-Rodríguez, Ali M. Huerta-Flores, J.M. Mora-Hernández, Leticia M. Torres-Martínez. Photocatalytic evolution of H_2 over visible-light active $LaMO_3$ (M: Co, Mn, Fe) perovskite materials: roles of oxygenated species in the catalytic performance. **Journal of Physics and Chemistry of Solids, Volume 136 (2020) 109189** https://doi.org/10.1016/j.jpcs.2019.109189 ISSN: 0022-3697
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16. M.R. Alfaro-Cruz, D. Sánchez-Martínez, L.M. Torres-Martínez. Optical properties of TiO_2 thin films deposited by DC sputtering and their photocatalytic perfomance in photoinduced process. **International Journal of Hydrogen Energy 44 (2019) 20017-20028.** https//:doi.org/10.1016/j.ijhydene.2019.06.043. ISSN: 0360-3199. (27 Junio 2019).
17. E. Luévano-Hipólito, Leticia M. Torres-Martínez, C. Triana, S.W. Lee. Ink-jet Bi_2O_3 films and powders for CO_2 capture and self-cleaning applications. **Thin Solid Films 677 (2019) 83-89.** https://doi.org/10.1016/j.tsf.2019.03.020. ISSN: 0040-6090. (01 May 2019).
18. M. Flores-Flores, E. Luévano-Hipólito, Leticia M. Torres-Martínez, Trong-On Do. CO_2 adsorption and photocatalytic reduction over $Mg(OH)_2$/CuO/Cu_2O under visible light to solar fuels. **Materials Chemistry and Physics 227 (2019) 90-97.** https://doi.org/10.1016/j.matchemphys.2019.01.062. ISSN 0254-0584. (01 Abril 2019).
19. Luis F. Garay-Rodríguez, S. Murcia-López, T. Andreu, Edgar Moctezuma, Leticia M. Torres-Martínez and J.R. Morante. Photocatalytic hydrogen evolution using bi-metallic (Ni/Pt) $Na_2Ti_3O_7$ whiskers: effect of the deposition. **Catalysts 2019, 9(3), 285-302.** https://doi.org/10.3390/catal9030285. EISSN 2073-4344. (20 Marzo 2019).
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21. Daniel Sánchez-Martínez, Diana B. Hernández-Uresti and Elvira Zarazúa-Morín. Facile preparation of $KBiO_3$/g-C_3N_4 composites with microwave irradiation for photocatalytic hydrogen production. Teresa Montalvo-Herrera, **Journal of Chemical Technology and Biotechnology 2019; 94:3440-3446.** DOI 10.1002/jctb.5921. Online ISSN:1097-4660 (8 Feb 2019).
22. Omar A Carrasco-Jaim, J.M. Mora-Hernández, Leticia M. Torres-Martínez, Edgar Moctezuma. A comparative study on the photocatalytic hydrogen production of $ATiO_3$ (A = Zn, Cd and Pb) perovskites and their photoelectrochemical properties. **Journal of Photochemistry & Photobiology A: Chemistry 371 (2019) 98-108.** https://doi.org/10.1016/j.jphotochem.2018.11.004. ISSN: 1010-6030. (15 Febrero 2019).
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July 2020

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