**Address**
University of Crete
Department of Chemistry
Voutes 71003, Heraklion, Crete, Greece
Phone: +30 2810 545052
Fax: +30 2810 545001
E-mail: ptrikal@uoc.gr
Website : www.chemistry.uoc.gr/ptrikalitis

**Personal details**

| | |
|---|---|
| Date of Birth: | March 17, 1971 |
| Place of Birth: | Thebes, Greece |
| Nationality: | Greek |
| Marital status: | Married, one child |

## Research Experience and Education

- **August 2015 – present:** Professor Department of Chemistry, University of Crete.
- **December 2009 – July 2015:** Associate Professor Department of Chemistry, University of Crete.
- **March 2004 - November 2009:** Assistant Professor, Department of Chemistry, University of Crete. Tenure awarded in June 2008.
- **September 2003 - February 2004:** Assistant Professor (non-tenure track position), Department of Materials Science and Engineering, University of Ioannina, Greece.
- **April 2003 - June 2003:** Marie Curie Industrial Postdoctoral Fellow: Agfa–Gevaert N.V. – R&D Materials, Antwerp, Belgium. Project: "Characterization of nanostructured materials for digital imaging applications using electron microscopy (SEM/TEM)".
- **May 1999 - March 2003:** Postdoctoral Research Associate, Michigan State University, Department of Chemistry, USA, Advisor Prof. Mercouri G. Kanatzidis. Project: "Synthesis, Characterization and Properties of novel semiconducting mesostructured chalcogenide-based materials".
- **September 1997 - May 1999 (20 months)**: Compulsory military service: Greek Air Force.
- **April 1993 - June 1997:** Postgraduate student, University of Ioannina, Greece. Advisor Prof. Philippos J. Pomonis. Ph.D. Thesis Title: "Preparation, Characterization and Catalytic Behavior of Perovskites Containing Vanadium".
- **September 1988 - April 1993**: Undergraduate student, Department of Chemistry, University of Ioannina, Greece.

## Administrative positions

- **Sept. 2018 – today:** Vice Chair of the Department of Chemistry, University of Crete
- **Sept. 2014 – Febr. 2016:** Vice Chair of the Research Committee of the Special Account for Research Funds of University of Crete

## Overview of Research Activities

The research activities are focused on the design, synthesis and structural characterization of novel nanoporous materials and study of their physical and chemical properties. In particular, our research group targets novel, multifunctional open-framework solids that combine porosity and advanced wall functionality (acid-base, redox and optoelectronic properties). Specific research areas include highly porous, functionalized metal-organic frameworks (MOFs), periodic nanoporous organosilicate materials and carbon-based nanostructures. These families of porous solids are targeted for application in i) selective gas sorption/separation processes ($CH_4$ & $H_2$ storage, $CO_2/CH_4$ & $CO_2/N_2$ separation), ii) selective capture and trapping of harmful gases including $NH_3$ and $SO_2$ and iii) separation of noble gases, in particular Kr/Xe. In addition, we are interested in the catalytic activity of MOFs in reactions such the catalytic $CO_2$ epoxidation and C-C cross coupling reactions. Furthermore, there is a strong collaboration with other research groups in projects of mutual interest such as in metal hydrides as hydrogen storage materials and

in novel polymeric nanocomposites.

The group has a significant know-how, knowledge and expertise on advanced materials synthesis using methods for solution, sol-gel and solid-state chemistry including hydrothermal, solvothermal and high temperature reactions. A great variety of modern and advanced characterization methods are routinely utilized by the group. Dr. P.N. Trikalitis has published **82** papers in high quality, international peer-reviewed journals including publications in *Nature, Science, Angew. Chem. Int. Ed., J. Am. Chem. Soc*., *Chem. Comm.* etc. His published work has received more than **4468** citations and his *h*-index is **36** (google scholar).

**Available Instrumentation and Techniques**

A strong effort has been devoted to establish a functional synthetic laboratory to execute the above research. Thus far the lab is equipment with two (2) nitrogen glove boxes (one dry and one wet), four (4) computer controlled high temperature furnaces (up to 1200 $^{o}$C), one (1) vacuum oven (up to 200 $^{o}$C) and four (4) conventional ovens (up to 300 $^{o}$C) for standard solvothermal syntheses. In addition, a double vacuum line has been installed, serving as sealing apparatus (for glass and quartz reaction tubes) or to perform standard Schlenk line techniques. Moreover, a commercial state-of-the-art volumetric gas adsorption apparatus (Quantachrome 1MP, micropore option) is fully operational, equipped with a cryo-cooler for unlimited time analyses in any temperature between 20 K - 320 K. This instrument is capable in performing accurate and detailed (micropore) volumetric analyses using $N_2$ and Ar gases at 77 K and 87 K respectively, for the determination of the specific surface area, total pore volume and pore size distribution, of porous materials. In addition, a multi-gas option has been installed that allows to record adsorption/desorption isotherms of other gases including $H_2$, $CH_4$, $CO_2$ and $NH_3$ as well as vapours (e.g. $H_2O$, ethanol, isopropanol), at different temperatures and up to 1 bar. In addition, a new, state-of-the-art volumetric instrument with two analysis stations (Autosorb-iQ-MP2) for measurements up to 1 bar is installed and greatly improved the capability measurements of the group. For high pressure gas-sorption measurements up to 20 bar, a gravimetric system (IGA-003) is available, equipped with a cryo-furnace and a mass-spectrometer.

The students in the lab are getting training in a variety of advanced synthetic techniques. As part of the standard materials characterization methods, the students become highly involved (hands on experience) with powder (PANalytical X'Pert Pro) and single-crystal (STOE IPDS II) X-ray diffraction measurements, thermal analysis techniques (TGA, DTA, DSC), electron microscopy (SEM/EDS and TEM), solid-state UV-vis/near IR diffuse reflectance, Raman and IR spectroscopy as well as multinuclear (e.g. $^{119}$Sn, $^{77}$Se) NMR spectroscopy in solution. The above instrumentation is provided from the Department of Chemistry and nearby, inside campus facilities.

**Selected invited talks**

1. **Novel functional MOFs with complex and intriguing structures: reticular chemistry and beyond.** Materials Beyond IV and Berkeley Global Science Institute Conference, June 18th-19th, **2019**, Fudan University, Shanghai, China.
2. **Rational Design and Synthesis of Metal-Organic Frameworks as Single Site Heterogeneous Catalysts for Chemical $CO_2$ Fixation with Epoxides**. 15$^{th}$ Panhellenic Catalysis Symposium Ioannina, 18-20 October 2018.
3. **Rational Design of Metal-Organic Frameworks using Reticular Chemistry Rules for Advanced Gas Storage/Separation Applications.** XXXIII Materials 2018 17-19 September, Nicosia, Cyprus.
4. **Rational Design of Metal-Organic Frameworks using Reticular Chemistry Rules for Advanced Gas Storage/Separation Applications.** 7th International Conference on "Transparent Conductive Materials, IS-TCM 2018", Chania, 14-19/10/2018.

5. **Reticular Chemistry and the Development of Novel Metal Organic Frameworks Based on Zr, Hf and Lanthanide Clusters**. North America Greece-Cyprus workshop on paramagnetic materials and current trends in molecular and nanoscale magnetism NAGC 2017, Paphos Cyprus, May 8-12, **2017**.
6. **Joint International Conference of the Hellenic Crystallographic Association and the Hellenic Society for Computational Biology and Bioinformatics HeCrA-HSCBB16.** October 7-9, **2016**, Athens, Greece.
7. **6th International Conference on Transparent Conductive Oxides.** October 9-13, **2016** Chania, Greece.
8. **Tuning of Porosity, Stability and $CO_2$ Adsorption Properties in Zr-based MOFs via Ligand Functionalization.** P.N. Trikalitis, 1st International Symposium on Energy Challenges and Mechanics, 8-10 July 2014, Aberdeen, Scotland, UK.
9. **Porous, Functionalized MOFs for Gas Sorption/Separation Applications.** P.N. Trikalitis, Northwestern University, June 27, 2014.
10. **Porous, Functionalized Coordination Polymers for Gas Sorption/Separation Applications.** P.N. Trikalitis, King Abdullah University of Science and Technology (KAUST), March 10, 2014, Saudi Arabia.
11. **Adventures in Synthesis of Functionalized MOF's and their Gas Sorption/Separation Properties** P.N. Trikalitis, Gordon Research Conference on "Inorganic Chemistry – The New Frontiers", University of New England, Biddeford, ME, USA, June 21-26 2009.

**Selected Publications in Peer-Reviewed Journals**

(1) Angeli, G. K.; Batzavali, D.; Mavronasou, K.; Tsangarakis, C.; Stuerzer, T.; Ott, H.; Trikalitis, P. N., Remarkable Structural Diversity between Zr/Hf and Rare-Earth MOFs via Ligand Functionalization and the Discovery of Unique (4,8)-c and (4,12)-connected Frameworks. *J. Am. Chem. Soc.* **2020,** *142* (37), 15986-15994.

(2) Panagiotou, N.; Liatsou, I.; Pournara, A.; Angeli, G. K.; Giappa, R. M.; Tylianakis, E.; Manos, M. J.; Froudakis, G. E.; Trikalitis, P. N.; Pashalidis, I.; Tasiopoulos, A. J., Water-stable 2-D Zr MOFs with exceptional UO22+ sorption capability. *Journal of Materials Chemistry A* **2020,** *8* (4), 1849-1857.

(3) Kourtellaris, A.; Moushi, E. E.; Spanopoulos, I.; Trikalitis, P. N.; Pissas, M.; Papaefstathiou, G. S.; Sanakis, Y.; Tasiopoulos, A. J., A Microporous Co(II)-Based 3-D Metal Organic Framework Built from Magnetic Infinite Rod-Shaped Secondary Building Units. *European Journal of Inorganic Chemistry* **2019,** *2019* (38), 4056-4062.

(4) Broom, D. P.; Webb, C. J.; Fanourgakis, G. S.; Froudakis, G. E.; Trikalitis, P. N.; Hirscher, M., Concepts for improving hydrogen storage in nanoporous materials. *International Journal of Hydrogen Energy* **2019,** *44* (15), 7768-7779.

(5) Tsoufis, T.; Tampaxis, C.; Spanopoulos, I.; Steriotis, T.; Katsaros, F.; Charalambopoulou, G.; Trikalitis, P. N., High-quality graphene sheets decorated with ZIF-8 nanocrystals. *Microporous Mesoporous Mater.* **2018,** *262*, 68-76.

(6) Bratsos, I.; Tampaxis, C.; Spanopoulos, I.; Demitri, N.; Charalambopoulou, G.; Vourloumis, D.; Steriotis, T. A.; Trikalitis, P. N., Heterometallic In(III)-Pd(II) Porous Metal-Organic Framework with Square-Octahedron Topology Displaying High CO2 Uptake and Selectivity toward CH4 and N-2. *Inorg. Chem.* **2018,** *57* (12), 7244-7251.

(7) Subrahmanyam, K. S.; Spanopoulos, I.; Chun, J. H.; Riley, B. J.; Thallapally, P. K.; Trikalitis, P. N.; Kanatzidis, M. G., Chalcogenide Aerogels as Sorbents for Noble Gases (Xe, Kr). *ACS Appl. Mater. Interfaces* **2017,** *9* (39), 33389-33394.

(8) Spanopoulos, I.; Tsangarakis, C.; Barnett, S.; Nowell, H.; Klontzas, E.; Froudakis, G. E.; Trikalitis, P. N., Directed assembly of a high surface area 2D metal-organic framework displaying the augmented

"kagome dual" (kgd-a) layered topology with high H-2 and CO2 uptake. *Inorganic Chemistry Frontiers* **2017,** *4* (5), 825-832.

(9) Kontos, A. G.; Kaltzoglou, A.; Siranidi, E.; Palles, D.; Angeli, G. K.; Arfanis, M. K.; Psycharis, V.; Raptis, Y. S.; Kamitsos, E. I.; Trikalitis, P. N.; Stoumpos, C. C.; Kanatzidis, M. G.; Falaras, P., Structural Stability, Vibrational Properties, and Photoluminescence in CsSnI3 Perovskite upon the Addition of SnF2. *Inorg. Chem.* **2017,** *56* (1), 84-91.

(10) Arachchige, I. U.; Armatas, G. S.; Biswas, K.; Subrahmanyam, K. S.; Latturner, S.; Malliakas, C. D.; Manos, M. J.; Oh, Y.; Polychronopoulou, K.; Poudeu, P. F. P.; Trikalitis, P. N.; Zhang, Q. C.; Zhao, L. D.; Peter, S. C., Mercouri G. Kanatzidis: Excellence and Innovations in Inorganic and Solid-State Chemistry. *Inorg. Chem.* **2017,** *56* (14), 7582-7597.

(11) Angeli, G. K.; Sartsidou, C.; Vlachaki, S.; Spanopoulos, I.; Tsangarakis, C.; Kourtellaris, A.; Klontzas, E.; Froudakis, G. E.; Tasiopoulos, A.; Trikalitis, P. N., Reticular Chemistry and the Discovery of a New Family of Rare Earth (4,8)-Connected Metal-Organic Frameworks with csq Topology Based on RE4(mu(3)-O)(2)(COO)(8) Clusters. *ACS Appl. Mater. Interfaces* **2017,** *9* (51), 44560-44566.

(12) Spanopoulos, I.; Tsangarakis, C.; Klontzas, E.; Tylianakis, E.; Froudakis, G.; Adil, K.; Belmabkhout, Y.; Eddaoudi, M.; Trikalitis, P. N., Reticular Synthesis of HKUST-like tbo-MOFs with Enhanced CH4 Storage. *J. Am. Chem. Soc.* **2016,** *138* (5), 1568-1574.

(13) Spanopoulos, I.; Bratsos, I.; Tampaxis, C.; Vourloumis, D.; Klontzas, E.; Froudakis, G. E.; Charalambopoulou, G.; Steriotis, T. A.; Trikalitis, P. N., Exceptional gravimetric and volumetric CO2 uptake in a palladated NbO-type MOF utilizing cooperative acidic and basic, metal-CO2 interactions. *Chem. Commun.* **2016,** *52* (69), 10559-10562.

(14) Kourtellaris, A.; Moushi, E. E.; Spanopoulos, I.; Tampaxis, C.; Charalambopoulou, G.; Steriotis, T. A.; Papaefstathiou, G. S.; Trikalitis, P. N.; Tasiopoulos, A. J., A microporous Cu2+ MOF based on a pyridyl isophthalic acid Schiff base ligand with high CO2 uptake. *Inorganic Chemistry Frontiers* **2016,** *3* (12), 1527-1535.

(15) Alezi, D.; Spanopoulos, I.; Tsangarakis, C.; Shkurenko, A.; Adil, K.; Belmabkhout, Y.; O'Keeffe, M.; Eddaoudi, M.; Trikalitis, P. N., Reticular Chemistry at Its Best: Directed Assembly of Hexagonal Building Units into the Awaited Metal-Organic Framework with the Intricate Polybenzene Topology, pbz-MOF. *J. Am. Chem. Soc.* **2016,** *138* (39), 12767-12770.

(16) Spanopoulos, I.; Bratsos, I.; Tampaxis, C.; Kourtellaris, A.; Tasiopoulos, A.; Charalambopoulou, G.; Steriotis, T. A.; Trikalitis, P. N., Enhanced gas-sorption properties of a high surface area, ultramicroporous magnesium formate. *Crystengcomm* **2015,** *17* (3), 532-539.

(17) Alezi, D.; Belmabkhout, Y.; Suyetin, M.; Bhatt, P. M.; Weselinski, L. J.; Solovyeva, V.; Adil, K.; Spanopoulos, I.; Trikalitis, P. N.; Emwas, A. H.; Eddaoudi, M., MOF Crystal Chemistry Paving the Way to Gas Storage Needs: Aluminum-Based soc-MOF for CH4, O-2, and CO2 Storage. *J. Am. Chem. Soc.* **2015,** *137* (41), 13308-13318.

(18) Xydias, P.; Spanopoulos, I.; Klontzas, E.; Froudakis, G. E.; Trikalitis, P. N., Drastic Enhancement of the CO2 Adsorption Properties in Sulfone-Functionalized Zr- and Hf-UiO-67 MOFs with Hierarchical Mesopores. *Inorg. Chem.* **2014,** *53* (2), 679-681.

(19) Magdysyuk, O. V.; Adams, F.; Liermann, H. P.; Spanopoulos, I.; Trikalitis, P. N.; Hirscher, M.; Morris, R. E.; Duncan, M. J.; McCormick, L. J.; Dinnebier, R. E., Understanding the adsorption mechanism of noble gases Kr and Xe in CPO-27-Ni, CPO-27-Mg, and ZIF-8. *Physical Chemistry Chemical Physics* **2014,** *16* (43), 23908-23914.

(20) Spanopoulos, I.; Xydias, P.; Malliakas, C. D.; Trikalitis, P. N., A Straight Forward Route for the Development of Metal-Organic Frameworks Functionalized with Aromatic -OH Groups: Synthesis, Characterization, and Gas (N-2, Ar, H-2, CO2, CH4, NH3) Sorption Properties. *Inorg. Chem.* **2013,** *52* (2), 855-862.

(21) Neofotistou, E.; Malliakas, C. D.; Trikalitis, P. N., Remarkable structural diversity and single-crystal-to-single-crystal transformations in sulfone functionalized lanthanide MOFs. *Crystengcomm* **2010,** *12* (4), 1034-1037.

(22) Papadaki, I.; Malliakas, C. D.; Bakas, T.; Trikalitis, P. N., Molecular Supertetrahedron Decorated with Exposed Sulfonate Groups Built from Mixed-Valence Tetranuclear Fe33+Fe2+(mu(3)-O)(mu(3)-SO4)(3)(-CO2)(3) Clusters. *Inorg. Chem.* **2009,** *48* (21), 9968-9970.

(23) Neofotistou, E.; Malliakas, C. D.; Trikalitis, P. N., Unprecedented Sulfone-Functionalized Metal-Organic Frameworks and Gas-Sorption Properties. *Chemistry-a European Journal* **2009,** *15* (18), 4523-4527.

(24) Neofotistou, E.; Malliakas, C. D.; Trikalitis, P. N., Novel coordination polymers based on the tetrathioterephthalate dianion as the bridging ligand. *Inorg. Chem.* **2007,** *46* (21), 8487-8489.

(25) Bag, S.; Trikalitis, P. N.; Chupas, P. J.; Armatas, G. S.; Kanatzidis, M. G., Porous semiconducting gels and aerogels from chalcogenide clusters. *Science* **2007,** *317* (5837), 490-493.

(26) Trikalitis, P. N.; Bakas, T.; Kanatzidis, M. G., Periodic hexagonal mesostructured chalcogenides based on platinum and SnSe4 (4-) and SnTe4 (4-) precursors. Solvent dependence of nanopore and wall organization. *J. Am. Chem. Soc.* **2005,** *127* (11), 3910-3920.

(27) Trikalitis, P. N.; Ding, N.; Malliakas, C.; Billinge, S. J. L.; Kanatzidis, M. G., Mesostructured selenides with cubic MCM-48 type symmetry: Large framework elasticity and uncommon resiliency to strong acids. *J. Am. Chem. Soc.* **2004,** *126* (47), 15326-15327.

(28) Trikalitis, P. N.; Petkov, V.; Kanatzidis, M. G., Structure of redox intercalated (NH4)(0.5)V2O5 center dot mH(2)O xerogel using the pair distribution function technique. *Chem. Mater.* **2003,** *15* (17), 3337-3342.

(29) Trikalitis, P. N.; Rangan, K. K.; Bakas, T.; Kanatzidis, M. G., Single-crystal mesostructured semiconductors with cubic Ia(3)over-bard symmetry and ion-exchange properties. *J. Am. Chem. Soc.* **2002,** *124* (41), 12255-12260.

(30) Rangan, K. K.; Trikalitis, P. N.; Canlas, C.; Bakas, T.; Weliky, D. P.; Kanatzidis, M. G., Hexagonal pore organization in mesostructured metal tin Sulfides built with Sn2S6 (4-) cluster. *Nano Letters* **2002,** *2* (5), 513-517.

(31) Petkov, V.; Trikalitis, P. N.; Bozin, E. S.; Billinge, S. J. L.; Vogt, T.; Kanatzidis, M. G., Structure of V2O5 center dot nH(2)O xerogel solved by the atomic pair distribution function technique. *J. Am. Chem. Soc.* **2002,** *124* (34), 10157-10162.

(32) Trikalitis, P. N.; Rangan, K. K.; Bakas, T.; Kanatzidis, M. G., Varied pore organization in mesostructured semiconductors based on the SnSe4 (4-) anion. *Nature* **2001,** *410* (6829), 671-675.