

ANDREA D'ANNA

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Academic appointments:

Professor of Chemical Engineering

Education:

M. Sc. Chemical Engineering, Università degli Studi di Napoli Federico II, cum laude (January 1983)

Academic Positions:

2014 – present Full Professor, Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, Università degli Studi di Napoli Federico II

2001-2013 Associate Professor, Dipartimento di Ingegneria Chimica, Università degli Studi di Napoli Federico II

1996-2000 Assistant Professor, Dipartimento di Ingegneria Chimica, Università degli Studi di Napoli Federico II

1986-1995 Researcher, Istituto Ricerche Combustione, CNR, Napoli

1984-1985 Process Engineering, Fertimont S.p.A., Milano

Teaching Courses:

Unit Operations of Chemical Engineering

Atmospheric Chemistry and Physics

Reaction Kinetics

Sustainable Engineering

Combustion

Boards, Advisory Committees, Professional Organizations:

since 2018 ACTRIS (Aerosol Clouds and Trace Gases) EU representative for the Università degli Studi di Napoli Federico II

since 2018 Expert Agence Nationale de la Recherche, French Ministry of Research and Higher Education, for the evaluation of the Laboratoire d'Excellence

since 2017 Chair of the Ph.D. School in Industrial Product and Process Engineering at Università degli Studi di Napoli Federico II.

since 2017 Member of the academic spin-off FORENSICS (FORensic ENGINEering ServiCeS), Università degli Studi di Napoli Federico II.

since 2014 Executive vice president of CNISM - Italian National Interuniversity Consortium for the Physical Sciences of Matter (Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia, CNISM).

since 2011 Scientific Advisory Committee, International Sooting Flame Workshops.

- since 2008 Member of the Executive Committee of the Mediterranean Combustion Symposia.
- since 2006 Member of the Steering Committee of the International Congress on Combustion by-Products and Their Health Effects.
- 2017 Member of the International Advisory Board of the Aerosol Technology conference, AT2018.
- 2011 – 2015 Chair of the Italian Section of the Combustion Institute.
- 2010 – 2015 Chair of the Ph.D. School in Chemical Engineering at Università degli Studi di Napoli Federico II.
- 2009 Co-editor of the book “Combustion Generated Fine Carbonaceous Particles”, KIT Scientific Publishing.
- 2005 – 2010 Executive Secretary of the Italian Section of the Combustion Institute.
- 2005 – 2008 Colloquium Co-Chair, 31st Symposium (International) on Combustion, Heidelberg 2006, and 32nd Symposium (International) on Combustion, Montreal 2008.
- 2002 Member of the local organization committee of the Ninth SIAM International Conference on Numerical Combustion (Sorrento, Italy).
- 1996 Member of the Local Arrangement Executive Staff of the 26th International Symposium on Combustion held in Napoli.

Visiting Research Fellow / Visiting Professor

Stanford University, November 2018

Awards and prizes

- 2019 Distinguished Paper for Soot, Nanoparticles, PAH and Other Large Molecules Colloquium “Insights into incipient soot formation by atomic force microscopy” at the 37th International Symposium on Combustion.
- 2018 Fellow of the Combustion Institute for “for innovative research in combustion science, especially in the area of soot formation”
- 2014 Silver Medal of the Combustion Institute for the Best Paper at the 34th Symposium “Coagulation of combustion generated nanoparticles in low and intermediate temperature regimes: An experimental study”.
- 2013 Distinguished Paper for Soot, Nanoparticles, PAH and Other Large Molecules Colloquium “Coagulation of combustion generated nanoparticles in low and intermediate temperature regimes: An experimental study” at the 34th International Symposium on Combustion.

Research Interests:

A.D'A. is interested in combustion processes and pollutant formation both at basic and applied levels. He has studied the chemistry of hydrocarbon oxidation at low and high temperatures and the chemistry of fuel rich sooting flames. He has studied the formation and destruction of carbonaceous aerosols including soot, nanoparticles and polycyclic aromatic hydrocarbons (PAH) developing new diagnostics for the physico-chemical characterization of these compounds. He has developed a detailed kinetic modeling able to simulate the oxidation of hydrocarbons and the formation of aromatic compounds of high molecular mass and soot in flames of different configurations. The model is able to reproduce the concentration, size distribution and chemistry of the particulate matter generated in combustion.

His current research focuses on the properties and performance of flame-synthesized nanoparticles and on their toxic effects. The main activity deals with carbonaceous nanoparticles for sensing applications (CQDs) and mesoporous nanoparticle films of metal-oxides for biomedical applications.

The major fields of interests are:

- Combustion chemistry, including the kinetics of pyrolysis of hydrocarbons, their oxidation and autoignition and mechanisms of pollutant formation;
- Combustion-generated particles and their effects on health and climate;
- Combustion-synthesized mesoporous nanoparticle films of TiO₂ for antibacterial and antimicrobial applications (Italian Patent Request No. 102017000078999; PCT Request No. PCT/IB2018/055113)
- Combustion in engines;
- Domestic burners design and development;
- Development of in-situ and ex-situ diagnostics for nanoparticle characterization;
- Design and development of condensation filters, electrostatic filters and post-combustors for particulate removal;
- Field measurements of pollutants, including PAH and particulate matter;
- Modeling of fire and toxic combustion dispersion in enclosed environment and industrial areas;
- Modeling the emission of pollutants from industrial flares and their dispersion in the atmosphere.

He is an active member of the international aerosol and combustion communities. He is reviewer of the most important international journals in combustion and environment fields.

He has been invited to deliver plenary lectures at prestigious combustion and aerosol conferences: Bilbao Talks on Aerosol Science, Bilbao, 2012; RECTA 2009, III Reunión Española de Ciencia y Tecnología de Aerosoles, Bilbao, 2009; European Aerosol Conference, Thessaloniki, Greece, 2008; Thirty-Second International Symposium on Combustion, Montreal (Canada), 2008.

He is co-author of more than 180 peer-reviewed publications and more than 200 presentations at national and international conferences. He has a Scopus H-index of 33 with 3400 citations and a Google H-index of 41.

The research of his group have been supported, over the years, by the European Community, by Italian Ministries and by many companies and research centres. He received research grants on the Development of the Lean Azimuthal Flame as an Innovative aviation gas turbine low-NO_x combustion concept (LEAFINNOX) granted by EU - Horizon 2020/Clean Sky JU - JTI-CS2-2018-CFP08-THT-01 (2019-2022); Valutazione della formazione del particolato secondario in aria confrontando carburanti e combustibili diversi granted by ENI s.p.a. (2019-2021); Development of Clean and Efficient Combustion Systems, research project with CNR granted by the Italian Ministry of Economic Development (2009-2018); Fine and Ultrafine Particles and their Health Effects, research project of Relevant National Interest (PRIN) granted by the Italian Ministry of Research (2008-2012); Innovative Methodologies for the Development of Automotive Engines, research project developed with FIAT Powertrain Technologies S.p.A. granted by the Italian Ministry of Economic Development (2011-2013); MILD Combustion, research project granted by the Italian Ministry of Economic Development in the framework of the INDUSTRIA 2015 project (2009-2013); SiATEAM - Soot in Aeronautics Towards Enhanced Aeroengine Combustor Modeling, FP7 project -GRD1-2001-41804 (2001-2006).

Selected publications (2013-2018)

1. M. Sirignano, J. Kent, A. D'Anna, "Modeling Formation and Oxidation of Soot in Nonpremixed Flames", *Energy Fuels* 2013, 27, 2303-2315. 10.1021/ef400057r
2. P. Pedata, N. Bergamasco, A. D'Anna, P. Minutolo, L. Servillo, N. Sannolo, M.L. Balestrieri, "Apoptotic and proinflammatory effect of combustion-generated organic nanoparticles in endothelial cells", *Toxicology Letters* 2013, 219 (3), 307-314. 10.1016/j.toxlet.2013.03.017
3. M. Commodo, L.A. Sgro, P. Minutolo, A. D'Anna "Characterization of Combustion-Generated Carbonaceous Nanoparticles by Size-Dependent Ultraviolet Laser Photoionization", *J. Phys. Chem. A* 2013, 117, 3980-3989. dx.doi.org/10.1021/jp401061d
4. D'Anna, A., M. Sirignano, "An Advanced Multi-Sectional Method for Particulate Matter Modeling in Flames", F. Battin-Leclerc et al. (eds.), *Cleaner Combustion, Green Energy and Technology*, Chap. 14, 363-388, Springer-Verlag London 2013. DOI: 10.1007/978-1-4471-5307-8_14
5. P. Minutolo, M. Commodo, A. Santamaria, G. De Falco, A. D'Anna "Characterization of flame-generated 2-D carbon nano-disks", *Carbon* 2014, 68 138-148. 10.1016/j.carbon.2013.10.073
6. M. Commodo, G. Tessitore, G. De Falco, P. Minutolo, A. D'Anna, "Photoionization study of soot precursors nanoparticles in laminar premixed ethylene/ethanol flames", *Combust. Sci. Technol.* 186 (4-5) 621-633 2014 10.1080/00102202.2014.883262.
7. M. Sirignano, M. Salamanca, A. D'Anna, "The role of dimethyl ether as substituent to ethylene on particulate formation in premixed and counter-flow diffusion flames", *Fuel* 126, 256-262, 2014, <http://dx.doi.org/10.1016/j.fuel.2014.02.039>

8. M. Sirignano, J. Kent, A D'Anna, "Further Experimental and Modelling Evidences of Soot Fragmentation in Flames", *Proc. Combust. Inst.* 35, 2014, 1779-1786, <http://dx.doi.org/10.1016/j.proci.2014.05.010>
9. Sirignano, M., Conturso, M., D'Anna, A., "Effect of furans on particle formation in diffusion flames: an experimental and modeling study", *Proc. Combust. Inst.* 35, 2015, 525-532, <http://dx.doi.org/10.1016/j.proci.2014.05.062>
10. Commodo M., Tessitore G., De Falco G., Bruno A., Minutolo P., D'Anna A., "Further details on particle inception and growth in premixed flames" *Proc. Combust. Inst.* 35, 2015, 1795-1502 <http://dx.doi.org/10.1016/j.proci.2014.06.004>
11. G. De Falco, M. Commodo, C. Bonavolontà, G.P. Pepe, P. Minutolo, A. D'Anna, "Optical and electrical characterization of carbon nanoparticles produced in laminar premixed flames", *Combust. Flame* 161(12), 3201-3210 (2014) <http://dx.doi.org/10.1016/j.combustflame.2014.05.021>
12. M. Gualtieri, L. Capasso, A. D'Anna, M. Camatini "Organic nanoparticles from different fuel blends: in vitro toxicity and inflammatory potential" *J. Appl. Toxicology* 34,1247-1255 (2014), 10.1002/jat.3067
13. G De Falco, M. Commodo, P. Minutolo, A. D'Anna "Flame-Formed Carbon Nanoparticles: Morphology, Interaction Forces and Hamaker Constant from AFM", *Aerosol Science and Technology*, 49:5, 281-289, DOI: 10.1080/02786826.2015.1022634
14. G. De Falco, A. Morgan, M. Commodo, P. Minutolo, A. D'Anna "Flame synthesis of MgO nanoparticles in a FASP Reactor" *Mater. Res. Soc. Symp. Proc. Vol. 1506* © 2013 Materials Research Society DOI: 10.1557/opl.2013.
15. G. De Falco, M. Commodo, P. Pedata, P. Minutolo, A. D'Anna "Carbon-TiO₂ Nanostructures: Flame Synthesis and Characterization" *Mater. Res. Soc. Symp. Proc. Vol. 1* © 2015 Materials Research Society DOI: 10.1557/opl.2015.195
16. M. Commodo, G. De Falco, A. Bruno, C. Borriello, P. Minutolo, A. D'Anna "Physicochemical evolution of nascent soot particles in a laminar premixed flame: from nucleation to early growth", *Combust. Flame*, 162 (10) Pages 3854-3863 <http://dx.doi.org/10.1016/j.combustflame.2015.07.022>
17. P. Pedata, T. Stoeger, R. Zimmermann, A. Peters, G. Oberdörster, A. D'Anna "Dangerous Negligence of the Smallest?" *Fiber and Particle Toxicology*, 2015, 12(1), 34.
18. D'Anna A., (2015) Kinetics of Soot Formation. In: Reedijk, J. (Ed.) Elsevier Reference Module in Chemistry, Molecular Sciences and Chemical Engineering. Waltham, MA: Elsevier. 30-Nov-2015 doi:10.1016/B978-0-12-409547-2.11524-0.
19. M. Commodo, G. De Falco, R. Larciprete, A. D'Anna, P. Minutolo "On the hydrophilic/hydrophobic character of carbonaceous nanoparticles formed in laminar premixed flames" *Exp. Therm. Fluid Sci.*, 73, 2016, 56-63.
20. M. Conturso, M. Sirignano, A. D'Anna "Effect of alkylated aromatics on particles formation in diffusion flames: an experimental study" *Exp. Therm. Fluid Sci.*, 73, 2016, 27-32.
21. M. Conturso, M. Sirignano, A. D'Anna "Effect of furanic biofuels on particles formation in premixed ethylene-air flames: An experimental study" *Fuel*, 175, 2016 137-145.
22. C. Russo, A. D'Anna, A. Ciajolo, M. Sirignano "Analysis of the chemical features of particles generated from ethylene and ethylene/2,5 dimethyl furan flames" *Combust. Flame* 167, 2016, 268-273.
23. M. Liberini, G. De Falco, F. Scherillo, A. Astarita, M. Commodo, P. Minutolo, A. D'Anna, A. Squillace "Nano-TiO₂ coatings on aluminum surfaces by aerosol flame synthesis" *Thin Solid Films* 609 (2016) 53-61
24. M. Sirignano, H. Ghiassi, A. D'Anna, J.A. S. Lighty "Temperature and oxygen effects on oxidation-induced fragmentation of soot particles", *Combust Flame* 171 (2016) 15-26.
25. Bartos, D., Dunn, M., Sirignano, M., D'Anna, A., & Masri, A. R. (2017). Tracking the evolution of soot particles and precursors in turbulent flames using laser-induced emission. *Proceedings of the Combustion Institute*, 36(2), 1869-1876.
26. Salenbauch, S., Sirignano, M., Marchisio, D. L., Pollack, M., D'Anna, A., & Hasse, C. (2017). Detailed particle nucleation modeling in a sooting ethylene flame using a Conditional Quadrature Method of Moments (CQMOM). *Proceedings of the Combustion Institute*, 36(1), 771-779.
27. De Falco, G., Commodo, M., D'Anna, A., & Minutolo, P. (2017). The evolution of soot particles in premixed and diffusion flames by thermophoretic particle densitometry. *Proceedings of the Combustion Institute*, 36(1), 763-770.
28. Conturso, M., Sirignano, M., & D'Anna, A. (2017). Effect of 2, 5-dimethylfuran doping on particle size distributions measured in premixed ethylene/air flames. *Proceedings of the Combustion Institute*, 36(1), 985-992.
29. Iavarone, S., Pascazio, L., Sirignano, M., De Candia, A., Fierro, A., De Arcangelis, L., & D'Anna, A. (2017). Molecular dynamics simulations of incipient carbonaceous nanoparticle formation at flame conditions. *Combustion Theory and Modelling*, 21(1), 49-61.
30. Sirignano, M., Bartos, D., Conturso, M., Dunn, M., D'Anna, A., & Masri, A. R. (2017). Detection of nanostructures and soot in laminar premixed flames. *Combustion and Flame*, 176, 299-308
31. De Falco, G., Moggia, G., Sirignano, M., Commodo, M., Minutolo, P., & D'Anna, A. (2017). Exploring Soot Particle Concentration and Emissivity by Transient Thermocouples Measurements in Laminar Partially Premixed Coflow Flames. *Energies*, 10(2), 232.
32. De Giorgi, M. G., Campilongo, S., Ficarella, A., De Falco, G., Commodo, M., & D'Anna, A. (2017). Pollutant Formation during the Occurrence of Flame Instabilities under Very-Lean Combustion Conditions in a Liquid-Fuel Burner. *Energies*, 10(3), 352.
33. De Falco, G., Terlizzi, M., Sirignano, M., Commodo, M., D'Anna, A., Aquino, R. P., Pinto, A., & Sorrentino, R. (2017). Human peripheral blood mononuclear cells (PBMCs) from smokers release higher levels of IL-1-like cytokines after exposure to combustion-generated ultrafine particles. *Scientific reports*, 7, 43016.
34. Sirignano, M., Ciajolo, A., D'Anna, A., & Russo, C. (2017). Chemical Features of Particles Generated in an Ethylene/Ethanol Premixed Flame. *Energy & Fuels*, 31(3), 2370-2377.
35. Merotto, L., Sirignano, M., Commodo, M., D'Anna, A., Dondè, R., & De Iulius, S. (2017). Experimental characterization and modeling for equivalence ratio sensing in non-premixed flames using chemiluminescence and laser-induced breakdown spectroscopy techniques. *Energy & Fuels*, 31(3), 3227-3233.
36. Conturso, M., Sirignano, M., & D'Anna, A. (2017). Effect of C₉H₁₂ alkylbenzenes on particle formation in diffusion flames: An experimental study. *Fuel*, 191, 204-211.
37. De Falco, G., Porta, A., Del Gaudio, P., Commodo, M., Minutolo, P., & D'Anna, A. (2017). Antimicrobial Activity of TiO₂ Coatings Prepared by Direct Thermophoretic Deposition of Flame-Synthesized Nanoparticles. *MRS Advances*, 2(28), 1493-1498.
38. Commodo, M., D'Anna, A., De Falco, G., Larciprete, R., & Minutolo, P. (2017). Illuminating the earliest stages of the soot formation by photoemission and Raman spectroscopy. *Combustion and Flame*, 181, 188-197.
39. Pascazio, L., Sirignano, M., & D'Anna, A. (2017). Simulating the morphology of clusters of polycyclic aromatic hydrocarbons: The influence of the intermolecular potential. *Combustion and Flame*, 185, 53-62.
40. De Falco, G., Porta, A., Petrone, A. M., Del Gaudio, P., El Hassanin, A., Commodo, M., Minutolo, P., Squillace, A. & D'Anna, A. (2017). Antimicrobial activity of flame-synthesized nano-TiO₂ coatings. *Environmental Science: Nano*, 4(5), 1095-1107.
41. De Falco, G., Commodo, M., Barra, M., Chiarella, F., D'Anna, A., Aloisio, A., Cassinese, A., & Minutolo, P. (2017). Electrical characterization of flame-soot nanoparticle thin films. *Synthetic Metals*, 229, 89-99
42. Commodo, M., Joo, P. H., De Falco, G., Minutolo, P., D'Anna, A., & Gülder, O. L. (2017). Raman spectroscopy of soot sampled in high-pressure diffusion flames. *Energy & Fuels*, 31(9), 10158-10164.

43. De Falco, G., Hassanin, A. E., Liberini, M., Commodo, M., Minutolo, P., Squillace, A., & D'Anna, A. (2017). Flame Synthesis and Characterization of TiO₂ Particles for the Production of Nanostructured Coatings. *Advanced Science Letters*, 23(6), 6020-6022.
44. De Falco, G., Colarusso, C., Terlizzi, M., Popolo, A., Pecoraro, M., Commodo, M., Minutolo, P., Sirignano, M., D'Anna, A., Aquino, R.P., Pinto, A., Molino, A., & Sorrentino, R. (2017). Chronic Obstructive Pulmonary Disease-Derived Circulating Cells Release IL-18 and IL-33 under Ultrafine Particulate Matter Exposure in a Caspase-1/8-Independent Manner. *Frontiers in immunology*, 8, 1415.
45. Commodo, M., De Falco, G., Minutolo, P., & D'Anna, A. (2018). Structure and size of soot nanoparticles in laminar premixed flames at different equivalence ratios. *Fuel*, 216, 456-462.
46. De Falco, G., Sirignano, M., Commodo, M., Merotto, L., Migliorini, F., Dondè, R., De Iulii, S., Minutolo, P., & D'Anna, A. (2018). Experimental and numerical study of soot formation and evolution in co-flow laminar partially premixed flames. *Fuel*, 220, 396-402.
47. Sirignano, M., & D'Anna, A. (2018). Filtration and coagulation efficiency of sub-10 nm combustion-generated particles. *Fuel*, 221, 298-302.
48. Salenbauch, S., Sirignano, M., Pollack, M., D'Anna, A., & Hasse, C. (2018). Detailed modeling of soot particle formation and comparison to optical diagnostics and size distribution measurements in premixed flames using a method of moments. *Fuel*, 222, 287-293.
49. Sirignano, M., Conturso, M., Magno, A., Di Iorio, S., Mancaruso, E., Vaglieco, B. M., & D'Anna, A. (2018). Evidence of sub-10 nm particles emitted from a small-size diesel engine. *Experimental Thermal and Fluid Science*, 95, 60-64.
50. Russo, C., Ciajolo, A., D'Anna, A., & Sirignano, M. (2018). Modelling analysis of PAH and soot measured in a premixed toluene-doped methane flame. *Fuel*, 234, 1026-1032.
51. Merotto, L., Sirignano, M., Commodo, M., D'Anna, A., Migliorini, F., Dondè, R., & De Iulii, S. (2018). Probing the equivalence ratio in partially premixed flames by combining optical techniques and modeling results. *Combustion Science and Technology*, 1-13.
52. De Falco, G., Ciardiello, R., Commodo, M., Del Gaudio, P., Minutolo, P., Porta, A., & D'Anna, A. (2018). TiO₂ nanoparticle coatings with advanced antibacterial and hydrophilic properties prepared by flame aerosol synthesis and thermophoretic deposition. *Surface and Coatings Technology*, 349, 830-837.
53. Schulz, F., Commodo, M., Kaiser, K., De Falco, G., Minutolo, P., Meyer, G., D'Anna, A., & Gross, L. (2018). Insights into incipient soot formation by atomic force microscopy. *Proceedings of the Combustion Institute* 37 (2019) 885–892.

Napoli 1 April 2019

Prof. Andrea D'Anna

