

Publicaties 2020

RESEARCH:

CHEMIE

- Metrologie voor biomethaan (Biomethane)

- Cuccia L., Sanz B., Castro D. B., Li J., van der Veen A.M.H., di Meane E. A., Moreno S., Culleton L. P., Vorin D., Senné C., Bougueroua F., Pyrée L., Courtois Y., Tastard C., "Development of standardized methods for the analysis of amines, terpenes and ammonia in biomethane", 19th International Congress of Metrology (CIM2019), EDP Sciences, 2019.
- Li J., Persijn S., de Krom I., Meuzelaar H., van der Veen A.M.H., "Metrology for biomethane conformity assessment: measure trace gas impurities in biomethane", 19th International Congress of Metrology (CIM2019), EDP Sciences, 2019.
- Van der Veen A.M.H., Nieuwenkamp G., Zalewska E.T., Li J., De Krom I., Persijn S., Meuzelaar H., "Advances in metrology for energy-containing gases and emerging demands", Metrologia, Accepted Manuscript online 6 March 2020.
- Nwaboh Anyangwe J., Meuzelaar H., Liu J. Persijn S.; Li J., Van der Veen A.M.H., Chatellier N., Papin a., Qu Z., Werhahn O., Ebert V., "Accurate analysis of HCl in biomethane using laser absorption spectroscopy and ion-exchange chromatography", Analyst, accepted for publication.
- Nwaboh J., Rajamaki T., Persijn, S., "Measurement techniques and test methods for measuring fluorine, chlorine and halogenated VOCs contents", Workshop on conformity assessment of biomethane, 22 January, 2019.
- Adriaan M.H. van der Veen, Gerard Nieuwenkamp, Ewelina Zalewska, Jianrong Li, Iris de Krom, Stefan Persijn en Heleen Meuzelaar, Advances in metrology for energy-containing gases and emerging demands, poster presentatie tijdens de 40th CCQM GAWG workshop, 8-12 april 2019, BIPM, Sèvres, Frankrijk.
- Heleen Meuzelaar, Stefan Persijn, Iris de Krom, Adriaan M.H. van der Veen en Jianrong Li, Reference gas standards and measurement methods for reactive impurities in biogas and biomethane, poster presentatie en conference proceedings tijdens de 6th International Conference on Renewable Energy Gas Technology (REGATEC2019), 20-21 mei 2019, Malmö, Zweden.
- Ewelina Zalewska, Jianrong Li, Adriaan M.H. van der Veen, Stefan Persijn en Iris de Krom, Gas standards and test methods for measuring relevant impurities in biogas and biomethane, mondelinge presentatie tijdens de 3rd International Conference & Exhibition on Downstream, Petroleum and Refining Technologies (PEFTEC2019), 22-23 mei 2019, Rotterdam, Nederland.
- Van der Veen A.M.H., "Standardisation in support of the conformity assessment of biomethane and biogas", International Seminar of Natural Gas Technology and Standardization, Beijing, PR China, 10 June 2019.
- Adriaan M.H. van der Veen, Iris de Krom, Roel Beelen, Paola Donata, Tamara Haagsma, Michel Tabak, Roland Verschuren and Franz Kramp, "Evaluation of a GC/BID system for trace component analysis in environmental and energy-related applications" Poster at GAS analysis 2019, The Hague, The Netherlands, 18 – 20 June 2019. Poster award!
- Jianrong Li, Stefan Persijn, Iris de Krom, Heleen Meuzelaar, Adriaan M.H. van der Veen, "Quo vadis, biomethane conformity assessment?", GAS analysis 2019, The Hague, The Netherlands, 18 – 20 June 2019.

- Lorena Cuccia, Béatrice Sanz, Dairo Ballestas Castro, Jianrong Li, Adriaan M.H. van der Veen, Elena Amico di Meane, Sergi Moreno, Lucy P. Culleton, Djimmy Vorin, Célia Senné, Faiza Bougueroua, Laurent Pyrée, Yann Courtois, and Christophe Tastard, “Development of standardized methods for the analysis of amines, terpenes and ammonia in biomethane”, 19th International Congress of Metrology (CIM2019), Paris, France, 24-26 September 2019.
 - Jianrong Li, Stefan Persijn, Iris de Krom, Heleen Meuzelaar, Adriaan M.H. van der Veen, “Metrology for biomethane conformity assessment: measure trace gas impurities in biomethane”, 19th International Congress of Metrology (CIM2019), Paris, France, 24-26 September 2019.
 - Van der Veen A.M.H., “Conformity assessment of biomethane and biogas”, Technical Seminar, Chengdu, PR China, 16 October 2019.
 - Jianrong Li and Adriaan M.H. van der Veen, “Summary of the EMPIR 16ENG05 Biomethane project progress”, presentations at NEN 310 408 Biomethaan meetings, NEN, Delft on the 4th of April and the 27th of November 2019.
 - Jianrong Li and Adriaan M.H. van der Veen, “Summary of the EMPIR 16ENG05 Biomethane project progress” presentations at NEN 310 408 Biomethane meetings, virtual meetings, on 28 May 2020.
 - Jianrong Li and Adriaan M.H. van der Veen, “Summary of the EMPIR 16ENG05 Biomethane project progress” presentations ISO/TC193/SC1/WG25 “Biomethane” meetings, virtual meetings, on 6 October 2020.
 - Jianrong Li and Adriaan M.H. van der Veen, “Summary of the EMPIR 16ENG05 Biomethane project progress” presentations NEN 310 408 Biomethane meetings, virtual meetings, on 6 October 2020.
- **Metrologie voor voertuigen op waterstof (MetroHyve)**
- Hydrogen purity analysis: suitability of sorbent tubes for trapping hydrocarbons, halogenated hydrocarbons and sulphur compounds; Karine Arrhenius, Haleh Bohlen, Oliver Büker, Iris de Krom, Dita Heikens, Janneke van Wijk; Applied Sciences, 10, no. 1 (2020): 120.
 - Design of gravimetric primary standards for field-testing of hydrogen refuelling stations; M.de Huu, M. Tschannen, H. Bissig, P. Stadelmann, O. Büker, M. MacDonald, R. Maury, P.T. Neuvonen, H.T. Petter and K. Rasmussen; Flow Measurement and Instrumentation; Volume 73, June 2020, 101747, <https://doi.org/10.1016/j.flowmeasinst.2020.101747>.
 - Arrhenius, K., Büker, O., Fischer, A., Persijn, S., & Moore, N. D. (2020). Development and evaluation of a novel analyser for ISO14687 hydrogen purity analysis. *Measurement Science and Technology*, 31(7), 075010.
 - Trace levels analysis of reactive ISO 14687 impurities in hydrogen fuel using laser-based spectroscopic detection methods; H. Meuzelaar, J. Liu, S. Persijn, j. van Wijk, A. vander Veen; Int. Journal of Hydrogen Energy, 45, issue 58 (2020).
 - Trace level analysis of reactive ISO-14687-2 impurities in hydrogen gas; H. Meuzelaar, A. Dragovic, J. van Wijk and S. Persijn; Gas analysis 2019, The Hague June 2019.
 - Metrology for Hydrogen Vehicles; A. Murugan et al; World Hydrogen Technologies Convention 2019, Tokyo.
- **LNG en LBG als transportbrandstof (LNG III)**
- Eckmann, P., von Preetzmann, N., Cavuoto, G., Li, J., van der Veen, A., Kleinrahm, R., Richter, M., *Density Measurements of (0.99 Methane + 0.01 Butane) and (0.98 Methane + 0.02 Isopentane) over the Temperature Range from (100 to 160) K at Pressures up to 10.8 MPa*, International Journal of Thermophysics (2020), Volume: 41:156, <https://doi.org/10.1007/s10765-020-02728-2>.
 - Hunt, A., Rusli, I., Schakel, M., Kenbar, A., *High-speed density measurement for LNG and other cryogenic fluids using electrical capacitance tomography*, Cryogenics, Volume 113, 2021, 103207, ISSN 0011-2275, <https://doi.org/10.1016/j.cryogenics.2020.103207>.

- ISO/TC 28/WG 20, ISO/DIS 21903:2018(E), 2018, *Refrigerated Hydrocarbon Fluids — Dynamic Measurement — Requirements and guidelines for the calibration and installation of flowmeters used for LNG and other refrigerated hydrocarbon fluids*.
 - Kenbar, A., Schakel, M., *Influence of Flow Disturbances on Measurement Uncertainty of Industry-Standard LNG Flow Meters*, Flow Measurement and Instrumentation, accepted.
 - Schakel, M. (auteur), Standiford, D. (reviewer), Smits, E. (reviewer), *Liquid nitrogen calibrations of industry standard LNG flow meters used in LNG custody transfer*, te downloaden via deze link: <https://lngmetrology.info/vsl-releases-first-results-of-flow-meters-calibrated-in-cryogenic-conditions-at-its-lng-test-facility/>, gepubliceerd: 20 December 2019.
 - von Preetzmann, N., Eckmann, P., van der Veen, A.M.H., Li, L., Richter, M., *Laboratory-Scale Liquefiers for Natural Gas – A Design and Assessment Study*, AIChE, undergoing review.
 - M.D. Schakel, M.P. van der Beek, I. Rahneberg, J. Schleichert, T. Einenkel, N. Rogge, Thomas Fröhlich, *Improvements to the Primary LNG Mass Flow Standard*, Flomeko conference, Lisbon, June 2019.
 - M.D. Schakel, O. Kerkhof, M.P. van der Beek, P. van den Herik, R. van Hof, P. Lucas, S. Wulfers, *LNG Mid-Scale Loop flow metering – Preliminary Test Results*, Flomeko conference, Lisbon, June 2019.
- **Metrologie voor geoxideerd kwik (MercOx)**
- GAS Analysis 2019, The Hague, the Netherlands, 18-20 June 2019:
 - Oral presentation: Iris de Krom “Comparable measurement results for mercury concentrations in gas emission sources and the atmosphere”.
 - Poster presentation: Ruben Ziel “VSL’s novel primary mercury vapour generator versus the Dumarey equation”.
 - ICMGP 2019, Krakow, Poland, 8 – 13 September 2019:
 - Oral presentation: Iris de Krom “Comparable measurement results for mercury concentrations in gas emission sources and the atmosphere”.
 - Poster presentation: Iris de Krom “VSL’s novel primary mercury vapour generator versus the Dumarey equation”.
 - I. de Krom, W. Bavius, R. Ziel, E. Efremov, D. van Meer, P. van Otterloo, I. van Andel, D. van Osselen, M. Heemskerk, A.M.H. van der Veen, M.A. Dexter, W.T. Corns, H. Ent, *Primary mercury gas standard for the calibration of mercury measurements*, *Measurement*, 169 (2021), 108351, Dio: 10.1016/j.measurement.2020.108351.
- **Metrologie voor stikstofdioxide (MetNO₂)**
- S. Persijn, *Purity analysis of gases used in the preparation of reference gas standards using a versatile OPO-based CRDS spectrometer*, paper in International Journal of Spectroscopy, Article ID 9845608, 7 pages, 2018, <https://doi.org/10.1155/2018/9845608>, (geaccepteerd voor publicatie).
 - S.T. Persijn, *Gas standards for nitrogen dioxide - Current status and new developments*, paper in Gasworld supplement, september 2017, 24-25 <https://www.gasworld.com/gas-standards-for-nitrogen-dioxide/2013384.article>
 - S. Persijn, *High accuracy static primary reference gas standards*, presentatie tijdens MetNO₂ Stakeholder workshop, Praag, Tsjechië, 7 maart 2018.
 - A. Baldan, J. Van Wijk, S. Persijn, G. Nieuwenkamp, I. De Krom, *The Challenge of Producing Trace Levels NO₂ Primary Gas Standards*, 18 maart 2019, Pittcon, Philadelphia, Pennsylvania.
 - E. Zalewska, S. Persijn, E. Efremov, L. Meijer, R. Beelen *Challenges in development of NO₂ primary reference materials in the range of 1 μmol/mol - 10 μmol/mol*. Presentatie op Gas Analysis Event 2019 in Den Haag.

- S. Persijn, E. Zalewska, *High accuracy static primary reference gas standards*, presentatie tijdens Final MetNO₂ Stakeholder workshop, Online bijeenkomst, 14 september 2020.
- **Metrologie voor klimaatrelevante VOCs (MetClimVOC)**
 - Atmospheric trace gases: “VOCs, impact climate change”, blog november 2020, geschreven voor de projectwebsite (<http://www.metclimvoc.eu/blog.html>).

ELEKTRICITEIT

- **Energiemanagement van elektrische spoorwegsysteem (MyRails)**
 - Helko E. van den Brom, Ronald van Leeuwen, and Ralph Hornecker, “Characterization of DC current sensors under distorted conditions for railway applications”, Conference on Electrical Systems for Aircraft, Railway, Ship Propulsion and Road Vehicles (ESARS) & International Transportation Electrification Conference (ITEC), Nottingham, UK, 7-9 November 2018.
 - Helko E. van den Brom, Ronald van Leeuwen, Ralph Hornecker, “Characterization of DC current sensors with AC distortion for railway applications”, IEEE Trans. Instrum. Meas., Vol. 68, pp. 2084-2090, June 2019, DOI 10.1109/TIM.2019.2898014.
 - Ronald van Leeuwen, Helko van den Brom, Gert Rietveld, Ernest Houtzager and Dennis Hoogenboom, “Measuring the Voltage Dependence of Current Transformers”, CPEM Conf. Dig., Denver, Colorado, 2020
 - Helko van den Brom and Ronald van Leeuwen, “Calibrating Sensors to Measure Braking Chopper Currents in DC Traction Units”, CPEM Conf. Dig., Denver, Colorado, 2020
 - Helko van den Brom, Domenico Giordano, Danielle Gallo, Andreas Wank, Yljon Seferi, “Accurate Measurement of Energy Dissipated in Braking Rheostats in DC Railway Systems”, CPEM Conf. Dig., Denver, Colorado, 2020
 - Domenico Giordano, Davide Signorino, Daniele Gallo, Helko E. van den Brom, and Martin Sira, “Methodology for the accurate measurement of the power dissipated by braking rheostats”, Sensors 2020, Vol. 20, 6935, DOI 10.3390/s20236935.
- **Elektromagnetische interferentie bij statische elektriciteitsmeters (MeterEMI)**
 - Fani Barakou, Paul Wright, Helko van den Brom, Gertjan Kok, and Gert Rietveld, “Detection Methods for Current Signals Causing Errors in Static Electricity Meters”, EMC Europe 2019, Barcelona, Spain, DOI 10.1109/EMCEurope.2019.8872120.
 - Helko van den Brom, Zander Marais, Dennis Hoogenboom, Ronald van Leeuwen, and Gert Rietveld, “A Testbed for Static Electricity Meter Testing with Conducted EMI”, EMC Europe 2019, Barcelona, Spain, DOI 10.1109/EMCEurope.2019.8872130.
 - Zander Marais, Helko van den Brom, Gert Rietveld, Ronald van Leeuwen, Dennis Hoogenboom, and Johan Rens, “Sensitivity of static energy meter reading errors to changes in non-sinusoidal load conditions”, EMC Europe 2019, Barcelona, Spain, DOI 10.1109/EMCEurope.2019.8872006.
 - Ronald van Leeuwen, Helko van den Brom, Dennis Hoogenboom, Gertjan Kok, Gert Rietveld, “Current waveforms of household appliances for advanced meter testing”, AMPS 2019, Aachen, Germany, DOI 10.1109/AMPS.2019.8897771.
 - H.E. van den Brom, G. Rietveld, D. Hoogenboom, R. van Leeuwen, Z. Marais, G.J.P. Kok, S. Sharma and M.G.A. van Veghel, “Towards improved standardization of electricity meter testing”, CPEM Conf. Dig., Denver, Colorado, 2020.
 - Z. Marais, H. E. van den Brom, G. Kok and M. G. A. van Veghel, "Reduction of Static Electricity Meter Errors by Broadband Compensation of Voltage and Current Channel Differences", IEEE Transactions on Instrumentation and Measurement, vol. 70, pp. 1-11, 2021, Art no. 1501511, DOI 10.1109/TIM.2020.3039631.
- **Verliesmetingen voor vermogenstransformatoren en reactoren (TrafoLoss)**
 - G. Ye, W. Zhao, and G. Rietveld, "Verification of high voltage divider with $10 \cdot 10^{-6}$ uncertainty", Proceedings of the 2020 Conference Precision Electromagnetic Measurements (CPEM2020), pp. 1 - 2 (2020). DOI: [10.1109/CPEM49742.2020.9191889](https://doi.org/10.1109/CPEM49742.2020.9191889).

- Gert Rietveld, Ernest Houtzager, Dennis Hoogenboom, and Gu Ye, “Reliable Power Transformer Efficiency Tests”, Proceedings of the 5th International Colloquium Transformer Research and Asset Management (ICTRAM), Opatija, Croatia, pp. 1-8 (2019). DOI: [10.5281/zenodo.3559845](https://doi.org/10.5281/zenodo.3559845).
- Gert Rietveld, Martin Fransen, Nicolas V.F. Blanc, and Eddy So, “Design and Testing of a Reference Setup for On-Site Power Measurements in High-Voltage Grids,” Proceedings of the 2019 IEEE 10th International Workshop on Applied Measurements for Power Systems (AMPS), Aachen, Germany, pp. 18-22 (2019). DOI: 10.1109/AMPS.2019.8897788.
- Anders Bergman, Allan Bergman, Bengt Jönsson, Gert Rietveld, Mathieu Sauzay, Jonathan Walmsley, John-Bjarne Sund, “*Estimating Uncertainty in Loss Measurement of Power Transformers*”, Proceedings of the 21st International Symposium on High Voltage Engineering, pp. 805 – 814 (2020). DOI: [10.5281/zenodo.3559837](https://doi.org/10.5281/zenodo.3559837).
Ook gepubliceerd in SPRINGER series Lecture Notes in Electrical Engineering, pp. 1- 12 (2019). DOI: 10.1007/978-3-030-31680-8_78.
- Anders Bergman, Gert Rietveld, “*Feasibility of direct measurement of HVDC converter station loss*”, CIGRE Science & Engineering (CSE), CSE015, pp. 85 – 93 (2019). <http://ri.diva-portal.org/smash/record.jsf?pid=diva2:1374357>.
- G. Rietveld, E. Mohns, E. Houtzager, H. Badura, D. Hoogenboom, “*Comparison of two Reference Setups for Calibrating Power Transformer Loss Measurement Systems*,” IEEE Transactions on Instrumentation and Measurement, **68**, No. 6, pp. 1732 – 1739 (2019). DOI: [10.1109/TIM.2018.2879171](https://doi.org/10.1109/TIM.2018.2879171).
- G. Rietveld, “TrafoLoss: loss measurements on Power Transformers and Reactors”, oral presentation at the 64th CENELEC TC14 meeting, Brussels, January 2020.
- G. Rietveld, “Reliable loss measurements on power transformers and reactors”, oral presentation at the NEC TC14-38 meeting, May 2020.
- G. Rietveld, G. Ye, and W. Zhao, , “Verification of voltage dividers with 10 μ V/V uncertainty”, oral presentation at the 2020 Conference Precision Electromagnetic Measurements (CPEM2020), Denver, August 2020.
- Gert Rietveld, “Reliable power transformer and reactor loss measurements”, International webinar for the India Power Transformer Industry, October 2020.
- **Metrologie voor digitale onderstations (FutureGrid II)**
 - E. Houtzager, T. Lehtonen, G. Rietveld, Z. Marais, “Metrology-grade Precision ADC for Power and Energy Applications”, accepted for publication in the proceedings of the 2020 Conference Precision Electromagnetic Measurements (CPEM2020), Denver, 2020.
- **Herleidbaarheid voor hoogfrequente metingen aan planaire componenten (TEMPT)**
 - K. Haddadi, E. Okada, K. Daffé, F. Mubarak, D. Théron, G. Dambrine, "Multiport Vector Network Analyzer Configured in RF Interferometric Mode for Reference Impedance Renormalization," IEEE MTT-S International Microwave Symposium, Boston, MA, pp. 1-3, 2019.
 - F. Mubarak, C.D. Martino, R. Toskovic, G. Rietveld, and M. Spirito, “Automated Contacting of On-Wafer Devices for RF Testing”, in Proc. of conference on precision electromagnetic measurements, 2020, Canada.
 - Faisal Mubarak, “Measurement Software for Advanced VNA Calibration and Covariance based Uncertainty Evaluation”, Fhi RF technology event 2020, 1-3 December 2020.
 - Raffaele Romano, Faisal Mubarak, Marco Spirito, Luca Galatro, “The HF-VNA, an Interferometric Approach For the Accurate Measurement Of Extreme Impedances”, mondelinge presentatie op IMS2019, Boston, Verenigde Staten.
 - Presentation, F. Mubarak, “High Frequency Measurement Facilities”, Philips Research, Philips, 2019-01-22, Eindhoven.
 - Presentation, F. Mubarak, “Measurement Applications of RF Interferometer-based VNAs”, EURAMET TC-EM SC-RF&MW Experts Meeting, 10 april 2019INTA, Spanje.

- Presentation, F. Mubarak, “ Enhancing measurement resolution of vector network analyzers with RF-interferometers”, Keysight Metrology Workshop, 11 april 2019, INTA, Spanje.
- Presentation, F. Mubarak, “Design and applications of interferometer based Vector Network Analyzers”, ME-Colloquium Delft University of Technology, 2019-09-26, Delft.
- Presentation, F. Mubarak, “Ultra low-noise broadband impedance measurements”, Quantum Opportunities Workshop, Delft University of Technology, 2019-11-2, Delft.
- F. Mubarak, C.D. Martino, R. Toskovic, G. Rietveld, and M. Spirito, “Automated Contacting of On-Wafer Devices for RF Testing”, in Proc. of conference on precision electromagnetic measurements, 2020, Canada.
- **Meettransformatoren voor power quality metingen (IT4PQ)**
 - G. Crotti, H.E. van den Brom, E. Mohns, R. Tinarelli, M. Luiso, R. Styblikova, M Agazar, H. Cayci, P. Mazza, J. Meyer, M. Almutairi, “Measurement Methods and Procedures for Assessing Accuracy of Instrument Transformers for Power Quality Measurements”, geaccepteerd voor publicatie in CPEM Conf. Dig., Denver, Colorado, 2020.

LENGTE

- **Metrologie voor dunne, complexe materialen**
 - O. El Gawhary, T. Van Mechelen and H. P. Urbach, *Reply*, Phys. Rev. Lett. **122**, 089302 (2019).
 - P. Sonin, J. de Pooter, O. El Gawhary, *Optische Metrologie op NMI-niveau*, Nederlands Tijdschrift voor Natuurkunde **9**, 8-13 (2019).
 - El Gawhary and P. Sonin, *Workshop on optical surface analysis methods for nanostructured layers: Measuring nano-dimensions by light*, BAM Adlershof, Berlin, Oct 10, 2019. Publiek: 30-40 wetenschappers en afgevaardigden van de industrie.
- **Metrologie voor extracellulaire deeltjes (MetVes II)**
 - M. Kuiper, A. van de Nes, R. Nieuwland, Z. Varga, E. van der Pol, Reliable measurements of extracellular vesicles by clinical flow cytometry, American Journal of Reproductive Immunology, 2020, e13350, <https://doi.org/10.1111/aji.13350>.
 - Poster presentatie: BIGSS 2020 (Biophotonics and Imaging Graduate Summer School 2020) <https://www.youtube.com/watch?v=J7pyZpDc9hA&t=32s>.
 - Er is een korte online presentatie van het project gepubliceerd als “VSL talk” in het kader van Wereldmetrologiedag op 20 mei 2020.

OPTICA

- **Metrologie voor aardobservatie en klimaat (METEOC3)**
 - Paul Dekker en Steven van den Berg “*SI-traceable tunable radiance source for spectroradiometer calibration*”, presentatie tijdens Workshop on Innovative Technologies for Space Optics, ESA ESTEC, Noordwijk, November 2019.
 - Steven van den Berg, Paul Dekker, Gerard Otter, Marcela Pelica Páscoa and Niels Dijkhuizen. “Calibration of a cube-sat spectroradiometer with a narrow-band widely tunable radiance source”, Research article accepted for publication with minor changes.

VOLUMETRIE

- **Metrologie voor luchtvervuilende emissies**
 - Conferentiepapier en bijbehorende poster zijn geaccepteerd voor presentatie op FLOMEKO 2019 (Lissabon, 26-28 juni 2018): M.D. Schakel, M. Workamp, J. Geršl, “*Cyclonic stack flow measurement uncertainties and impact on annualised mass emission measurements*”.
 - Stanislav Knotek , Marcel Workamp , Jan Geršl & Menne D. Schakel (2021). Narrow stack emissions: *Errors in flow rate measurement due to disturbances and swirl*, Journal of the Air & Waste Management Association, 71:1, 46-59, DOI:10.1080/10962247.2020.1832621.
- **Debietmetingen voor hernieuwbare gassen en gasmengsels in het gasnet (NewGasMet)**
 - MacDonald, M., *Flow metering of renewable gases*, EMPIR-project presentatie tijdens de European Energy Gases workshop, “Exploring current and future scenarios within energy gas industries that may create new measurement challenges”, National Physical Laboratory,

Teddington, UK, 22 Januari 2020; [European energy gases workshop Registration, Wed 22 Jan 2020 at 09:00 | Eventbrite](#).

- Op 4 november 2020 en op 26 mei 2021: communicatie over project in standaardisatie-commissie 310066 “Debiet- en hoeveelheidsmeting”.
- Online EMPIR-project news features (<https://newgasmeter.eu/news>):
 - “Durability test protocol Newgasmeter”, 10 maart 2020.
 - “2nd newsletter Newgasmeter”, 6 november 2020.
- **Metrologie voor Portable Emission Measurement Systems (MetroPEMS)**
 - Tweetal presentaties gedurende de “MetroPEMS stakeholder workshop” op 15 december 2020:
 - Algemeen: “MetroPEMS calibration capabilities at VSL”.
 - M.b.t. WP3 “EFM: Robust, reliable, and application-oriented exhaust flow meter calibration”.