

## Selected RF sensor publications since 2013

as of March 31, 2026

### Journals and Papers

- C. Steiner, V. Malashchuk, D. Kubinski, G. Hagen, R. Moos:  
Microwave-Based State Diagnosis of Three-Way Catalysts: Impact Factors and Application Recommendations  
**open access - free** *Sensors*, **24**, 4091 (2024), doi: [10.3390/s24134091](https://doi.org/10.3390/s24134091)
- S. Walter, J. Baumgärtner, G. Hagen, D. Schönauer-Kamin, J. Kita, R. Moos:  
Dielectric Properties of Materials Used for Microwave-Based NO<sub>x</sub> Gas Dosimeters  
**open access - free** *Sensors*, **24**, 2951 (2024), doi: [10.3390/s24092951](https://doi.org/10.3390/s24092951)
- S. Walter, P. Schwanzer, G. Hagen, H.-P. Rabl, M. Dietrich, R. Moos:  
Combined Ash and Soot Monitoring for Gasoline Particulate Filters Using a Radio-Frequency-Based Sensor  
**open access - free** *Emission Control Science and Technology*, **10**, 1-9 (2024), doi: [10.1007/s40825-023-00235-y](https://doi.org/10.1007/s40825-023-00235-y)
- S. Walter, P. Schwanzer, G. Hagen, H.-P. Rabl, M. Dietrich, R. Moos:  
Soot Monitoring of Gasoline Particulate Filters Using a Radio-Frequency-Based Sensor  
**open access - free** *Sensors*, **23**, 7861 (2023), doi: [10.3390/s23187861](https://doi.org/10.3390/s23187861)
- V. Malashchuk, S. Walter, M. Engler, G. Hagen, G. Link, J. Jelonnek, F. Raß, R. Moos:  
Reducing Cold-Start Emissions by Microwave-Based Catalyst Heating: Simulation Studies  
**open access - free** *Topics in Catalysis*, **66**, 1031-1036 (2023), doi: [10.1007/s11244-023-01788-6](https://doi.org/10.1007/s11244-023-01788-6)
- S. Walter, G. Hagen, D. Koch, A. Geißelmann, R. Moos:  
On the Suitability of NO<sub>x</sub>-Storage-Catalysts for Hydrogen Internal Combustion Engines and a Radio Frequency-Based NO<sub>x</sub> Loading Monitoring  
**open access - free** *Topics in Catalysis*, **66**, 964-972 (2023), doi: [10.1007/s11244-022-01727-x](https://doi.org/10.1007/s11244-022-01727-x)
- C. Steiner, G. Hagen, I. Kogut, H. Fritze, R. Moos:  
Analysis of defect mechanisms in nonstoichiometric ceria-zirconia by the microwave cavity perturbation method  
**open access - free** *Journal of the American Ceramic Society*, **106**, 2875-2892 (2023), doi: [10.1111/jace.18938](https://doi.org/10.1111/jace.18938)
- V. Malashchuk, A. Jess, R. Moos:  
Operando monitoring of gas drying by adsorption on supported ionic liquids: Determination of velocity of adsorption front by microwaves  
*Sensors and Actuators B: Chemical*, **380**, 133291 (2023), doi: [10.1016/j.snb.2023.133291](https://doi.org/10.1016/j.snb.2023.133291)
- S. Walter, P. Schwanzer, C. Steiner, G. Hagen, H.-P. Rabl, M. Dietrich, R. Moos:  
Mixing Rules for an Exact Determination of the Dielectric Properties of Engine Soot Using the Microwave Cavity Perturbation Method and Its Application in Gasoline Particulate Filters  
**open access - free** *Sensors*, **22**, 3311 (2022), doi: [10.3390/s22093311](https://doi.org/10.3390/s22093311)
- C. Steiner, G. Hagen, I. Kogut, H. Fritze, R. Moos:  
Analysis of defect chemistry and microstructural effects of non-stoichiometric ceria by the high-temperature microwave cavity perturbation method  
*Journal of the European Ceramic Society*, **42**, 499-511 (2022), doi: [10.1016/j.jeurceramsoc.2021.08.053](https://doi.org/10.1016/j.jeurceramsoc.2021.08.053)
- V. Malashchuk, A. Jess, R. Moos:  
Determination of water loading of supported ionic liquids by microwave analysis - A contribution for operando monitoring of gas drying by adsorption  
*Sensors and Actuators B: Chemical*, **335**, 129646 (2021), doi: [10.1016/j.snb.2021.129646](https://doi.org/10.1016/j.snb.2021.129646)
- C. Steiner, S. Walter, V. Malashchuk, G. Hagen, I. Kogut, H. Fritze, R. Moos:  
Determination of the Dielectric Properties of Storage Materials for Exhaust Gas Aftertreatment Using the Microwave Cavity Perturbation Method  
**open access - free** *Sensors*, **20**, 6024 (2020), doi: [10.3390/s20216024](https://doi.org/10.3390/s20216024)
- S. Walter, P. Schwanzer, G. Hagen, G. Haft, H.-P. Rabl, M. Dietrich, R. Moos:  
Modelling the Influence of Different Soot Types on the Radio-Frequency-Based Load Detection of Gasoline Particulate Filters  
**open access - free** *Sensors*, **20**, 2659 (2020), doi: [10.3390/s20092659](https://doi.org/10.3390/s20092659)
- C. Steiner, V. Malashchuk, D. Kubinski, G. Hagen, R. Moos:  
Catalyst State Diagnosis of Three-Way Catalytic Converters Using Different Resonance Parameters—A Microwave Cavity Perturbation Study  
**open access - free** *Sensors*, **19**, 3559 (2019), doi: [10.3390/s19163559](https://doi.org/10.3390/s19163559)
- M. Dietrich, G. Hagen, R. Moos:  
Dielectric properties and temperature dependency of automotive catalyst coatings and substrate materials: Experimental results, influences and approximation approach  
*Functional Materials Letters*, **12**, 195024 (2019), doi: [10.1142/S1793604719500243](https://doi.org/10.1142/S1793604719500243)
- C. Steiner, A. Gänzler, M. Zehentbauer, G. Hagen, M. Casapu, S. Müller, J.-D. Grunwaldt, R. Moos:  
Oxidation State and Dielectric Properties of Ceria-Based Catalysts by Complementary Microwave Cavity Perturbation and X-Ray Absorption Spectroscopy Measurements  
*Topics in Catalysis*, **62**, 227-236 (2019), doi: [10.1007/s11244-018-1110-3](https://doi.org/10.1007/s11244-018-1110-3)
- M. Dietrich, G. Hagen, R. Moos:  
Modelling Both the NH<sub>3</sub> Storage on Automotive SCR Catalysts and the Radio-Frequency-Based Response

*Topics in Catalysis*, **62**, 172-178 (2019), doi: [10.1007/s11244-019-01140-x](https://doi.org/10.1007/s11244-019-01140-x)

S. Walter, L. Ruwisch, U. Göbel, G. Hagen, R. Moos:  
Radio Frequency-Based Determination of the Oxygen and the NO<sub>x</sub> Storage Level of NO<sub>x</sub> Storage Catalysts  
*Topics in Catalysis*, **62**, 157-163 (2019), doi: [10.1007/s11244-018-1079-y](https://doi.org/10.1007/s11244-018-1079-y)

M. Dietrich, G. Hagen, W. Reitmeier, K. Burger, M. Hien, P. Grass, D. Kubinski, J. Visser, R. Moos:  
Radio-Frequency-Controlled Urea Dosing for NH<sub>3</sub>-SCR Catalysts: NH<sub>3</sub> Storage Influence to Catalyst Performance under Transient Conditions  
**open access - free** *Sensors*, **17**, 2746 (2017), doi: [10.3390/s17122746](https://doi.org/10.3390/s17122746)

M. Dietrich, G. Hagen, W. Reitmeier, K. Burger, M. Hien, P. Grass, D. Kubinski, J. Visser, R. Moos:  
Radio-Frequency-Based NH<sub>3</sub>-Selective Catalytic Reduction Catalyst Control: Studies on Temperature Dependency and Humidity Influences  
**open access - free** *Sensors*, **17**, 1615 (2017), doi: [10.3390/s17071615](https://doi.org/10.3390/s17071615)

M. Dietrich, C. Steiner, G. Hagen, R. Moos:  
Radio-Frequency-Based Urea Dosing Control for Diesel Engines with Ammonia SCR Catalysts  
*SAE International Journal of Engines*, **10**, 1638-1645 (2017), doi: [10.4271/2017-01-0945](https://doi.org/10.4271/2017-01-0945)

D. Rauch, M. Dietrich, T. Simons, U. Simon, A. Porch, R. Moos:  
Microwave Cavity Perturbation Studies on H-form and Cu Ion-Exchanged SCR Catalyst Materials: Correlation of Ammonia Storage and Dielectric Properties  
*Topics in Catalysis*, **60**, 243-249 (2017), doi: [10.1007/s11244-016-0605-z](https://doi.org/10.1007/s11244-016-0605-z)

M. Feulner, F. Seufert, A. Müller, G. Hagen, R. Moos:  
Influencing Parameters on the Microwave-Based Soot Load Determination of Diesel Particulate Filters  
*Topics in Catalysis*, **60**, 374-380 (2017), doi: [10.1007/s11244-016-0626-7](https://doi.org/10.1007/s11244-016-0626-7)

M. Feulner, G. Hagen, K. Hottner, S. Redel, A. Müller, R. Moos:  
Comparative Study of Different Methods for Soot Sensing and Filter Monitoring in Diesel Exhausts  
**open access - free** *Sensors*, **17**, 400 (2017), doi: [10.3390/s17020400](https://doi.org/10.3390/s17020400)

R. Moos, D. Rauch, M. Votsmeier, D. Kubinski:  
Review on Radio Frequency Based Monitoring of SCR and Three Way Catalysts  
*Topics in Catalysis*, **59**, 961-969 (2016), doi: [10.1007/s11244-016-0575-1](https://doi.org/10.1007/s11244-016-0575-1)

M. Dietrich, D. Rauch, U. Simon, A. Porch, R. Moos:  
Ammonia Storage Studies on H-ZSM-5 Zeolites by Microwave Cavity Perturbation: Correlation of Dielectric Properties with Ammonia Storage  
**open access - free** *Journal of Sensors and Sensor Systems*, **4**, 263-269 (2015), doi: [10.5194/jsss-4-263-2015](https://doi.org/10.5194/jsss-4-263-2015)

M. Dietrich, C. Jahn, P. Lanzerath, R. Moos:  
Microwave-Based Oxidation State and Soot Loading Determination on Gasoline Particulate Filters with Three-Way Catalyst Coating for Homogenously Operated Gasoline Engines  
**open access - free** *Sensors*, **15**, 21971-21988 (2015), doi: [10.3390/s150921971](https://doi.org/10.3390/s150921971)

G. Beulertz, M. Votsmeier, R. Moos:  
In operando Detection of Three-Way Catalyst Aging by a Microwave-Based Method: Initial Studies  
**open access - free** *Applied Sciences*, **5**, 174-186 (2015), doi: [10.3390/app5030174](https://doi.org/10.3390/app5030174)

R. Moos:  
Microwave-Based Catalyst State Diagnosis - State of the Art and Future Perspectives  
*SAE International Journal of Engines*, **8**, 1240-1245 (2015), doi: [10.4271/2015-01-1042](https://doi.org/10.4271/2015-01-1042)

D. Rauch, D. Kubinski, G. Cavataio, D. Upadhyay, R. Moos:  
Ammonia Loading Detection of Zeolite SCR Catalysts using a Radio Frequency based Method  
*SAE International Journal of Engines*, **8**, 1126-1135 (2015), doi: [10.4271/2015-01-0986](https://doi.org/10.4271/2015-01-0986)

G. Beulertz, M. Votsmeier, R. Moos:  
Effect of propene, propane, and methane on conversion and oxidation state of three-way catalysts: A microwave cavity perturbation study  
*Applied Catalysis B: Environmental*, **165**, 369-377 (2015), doi: [10.1016/j.apcatb.2014.09.068](https://doi.org/10.1016/j.apcatb.2014.09.068)

D. Rauch, G. Albrecht, D. Kubinski, R. Moos:  
A microwave-based method to monitor the ammonia loading of a vanadia-based SCR catalyst  
*Applied Catalysis B: Environmental*, **165**, 36-42 (2015), doi: [10.1016/j.apcatb.2014.09.059](https://doi.org/10.1016/j.apcatb.2014.09.059)

M. Dietrich, D. Rauch, A. Porch, R. Moos:  
A laboratory test setup for in situ measurements of the dielectric properties of catalyst powder samples under reaction conditions by microwave cavity perturbation: set up and initial tests  
**open access - free** *Sensors*, **14**, 16856-16868 (2014), doi: [10.3390/s140916856](https://doi.org/10.3390/s140916856)

D. Rauch, D. Kubinski, U. Simon, R. Moos:  
Detection of the ammonia loading of a Cu Chabazite SCR catalyst by a radio frequency-based method  
*Sensors and Actuators B: Chemical*, **205**, 88-93 (2014), doi: [10.1016/j.snb.2014.08.019](https://doi.org/10.1016/j.snb.2014.08.019)

M. Feulner, G. Hagen, A. Piontkowski, A. Müller, G. Fischerauer, D. Brüggemann, R. Moos:  
In-Operation Monitoring of the Soot Load of Diesel Particulate Filters - Initial Tests

*Topics in Catalysis*, **56**, 483-488 (2013), doi: [10.1007/s11244-013-0002-9](https://doi.org/10.1007/s11244-013-0002-9)

## Book Contributions

S. Walter, P. Schwanzer, G. Hagen, G. Haft, M. Dietrich, H.-P. Rabl, R. Moos:  
Hochfrequenzsensorik zur direkten Beladungserkennung von Benzinpartikelfiltern  
In: T. Tille (Hrsg.), *Automobil-Sensorik 3 - Prinzipien, Technologien und Anwendungen*, Springer-Verlag, Heidelberg (2020), p. 185-208, 978-3-662-61259-0 (gedruckt), ISBN 978-3-662-61260-6 (online), doi: [10.1007/978-3-662-61260-6\\_7](https://doi.org/10.1007/978-3-662-61260-6_7)

R. Moos, M. Dietrich:  
Beladungsregelung eines NH<sub>3</sub>-SCR-Katalysator-Systems auf minimale NO<sub>x</sub>-Emissionen mittels Hochfrequenzsensorik  
In: T. Tille (Hrsg.), *Automobil-Sensorik 2 - Systeme, Technologien und Applikationen*, Springer-Verlag, Heidelberg (2018), p. 225-244, ISBN 978-3-662-56309-0 (gedruckt), ISBN 978-3-662-56310-6 (online), doi: [10.1007/978-3-662-56310-6\\_10](https://doi.org/10.1007/978-3-662-56310-6_10)

R. Moos:  
Mikrowellengestützte Systeme zur Zustandserkennung von Abgaskatalysatoren und Abgasfiltern im Überblick  
In: *Automobil-Sensorik - Ausgewählte Sensorprinzipien und deren automobiler Anwendung*, Springer-Verlag, Heidelberg (2016), p. 115-132, ISBN 978-3-662-48943-7 (gedruckt), doi: [10.1007/978-3-662-48944-4\\_6](https://doi.org/10.1007/978-3-662-48944-4_6)

## Doctoral Theses

M. Feulner:  
Methoden der Rußdetektion im Dieselabgas  
(Methods for soot detection in diesel exhausts)  
In: *Bayreuther Beiträge zur Sensorik und Messtechnik*, Bd. 28, Shaker-Verlag, Düren (2019), ISBN: [978-3-8440-6926-6](https://doi.org/978-3-8440-6926-6)

M. Dietrich:  
Anwendung der hochfrequenzgestützten Zustandsdiagnose zur Überwachung und Regelung von SCR-Katalysatoren  
(Application of radio frequency-based techniques for monitoring and control of SCR catalysts)  
In: *Bayreuther Beiträge zur Sensorik und Messtechnik*, Bd. 23, Shaker-Verlag, Aachen (2018), ISBN: [978-3-8440-5782-9](https://doi.org/978-3-8440-5782-9)

D. Rauch:  
Mikrowellengestützte Untersuchung des NH<sub>3</sub>-Speicherverhaltens von SCR-Katalysatormaterialien  
(Microwave-based Characterization of the Ammonia Loading of SCR Catalysts Materials)  
In: *Bayreuther Beiträge zur Sensorik und Messtechnik*, Bd. 20, Shaker-Verlag, Aachen (2017), ISBN: [978-3-8440-5081-3](https://doi.org/978-3-8440-5081-3)

G. Beulertz:  
Anwendung der hochfrequenzgestützten Zustandsdiagnose für Dreiwegekatalysatoren  
(Application of the microwave-based state diagnosis for three way catalysts)  
In: *Bayreuther Beiträge zur Sensorik und Messtechnik*, Bd. 18, Shaker-Verlag, Aachen (2017), ISBN: [978-3-8440-4988-6](https://doi.org/978-3-8440-4988-6)

S. Reiß:  
Direkte Zustandssensorik von Automobilabgaskatalysatoren  
(Direct diagnosis of automotive exhaust gas catalysts)  
In: *Bayreuther Beiträge zur Sensorik und Messtechnik*, Bd. 9, Shaker-Verlag, Aachen (2012), ISBN: [978-3-8440-0841-8](https://doi.org/978-3-8440-0841-8)