

**14<sup>th</sup> International Symposium on Hazards,  
Prevention, and Mitigation  
of Industrial Explosions**

July 11-15, 2022  
Braunschweig, Germany



<b>Monday, July 11</b>	
08:00	Shuttle Busses to PTB leave at the hotels
<b>Room</b>	<b>PTB Seminar Centre</b>
<b>08:00</b> - <b>09:00</b>	<b>Registration</b>
<b>Room</b>	<b>Lecture Hall</b>
<b>09:00</b> - <b>09:45</b>	<b>Opening</b> with welcoming speeches from Prof. Dr. Cornelia Denz, PTB, Germany (President of Physikalisch-Technische Bundesanstalt) Prof. Dr. Trygve Skjold, University of Bergen, Norway (Chair of the International Organizing Committee) Dr. Michael Beyer, PTB, Germany (Chair of the Local Organizing Committee)
<b>Chair</b>	Michael Beyer
<b>Room</b>	<b>Lecture Hall</b>
<b>09:45</b> - <b>10:45</b>	<b>Plenary Session</b>
<b>Chair</b>	Michael Beyer
<b>09:45</b>	<b>New defined units for chemistry – exactly!</b>
	Bernd Güttler Physikalisch-Technische Bundesanstalt
<b>10:45</b> - <b>11:15</b>	<b>Coffee break</b>

**Monday, July 11**

Room	Lecture Hall	Room A	Room B
11:15 - 12:45	<b>Session 1</b> Advances in explosion protection: Strategies, measures, and protective equipment I	<b>Session 2</b> Explosion modelling and simulation I	Free
<b>Chair</b>	Dieter Gabel	Josué Melguizo-Gavilanes	
11:15	<b>Flameproof enclosure and pressure relief: Status quo (#8)</b>	<b>Investigation on flame propagation and particle decomposition behavior of dust explosion in MIKE 3 apparatus (#19)</b>	
	Sabrina Herbst, Johanna Gerlach; Leo Siegle, Frank Engelmann, Thorsten Arnhold	Yangyue Pan, Christoph Spijker, Harald Raupenstrauch	
11:45	<b>Influence of vent distribution on the violence of a gas explosion (#66)</b>	<b>TGA-FTIR for kinetic and evolved gas analysis of the coal particles in dust deflagration (#20)</b>	
	Jérôme Daubech, Emmanuel Leprette, Christophe Proust	Yangyue Pan, Christoph Spijker, Harald Raupenstrauch	
12:15	<b>Gas phase explosions in oxygen enriched atmospheres (#69)</b>	<b>A Numerical Model for the Minimum Ignition Temperature of Dust Clouds (#53)</b> <b>Online presentation (postponed to session 23)</b>	
	Simon Egan	Tengfei Chen, Jo van Caneghem, Jan Degreève, Jan Berghmans, Filip Verplaetsen, Maarten Vanierschot	
12:45 - 14:00	<b>Lunch break</b>		

Monday, July 11			
Room	Lecture Hall	Room A	Room B
14:00 - 15:30	<b>Session 3 Explosion testing I</b>	<b>Session 4 Hydrogen safety I</b>	<b>Free</b>
<b>Chair</b>	Regis Bauwens	Chunkan Yu	
14:00	<b>Acceleration sensitivity of piezoelectric pressure sensors and the influence on the measurement of explosion pressures (#29)</b>	<b>Large-scale tests to investigate the consequences of exposing cryogenic storage vessels containing liquid hydrogen to a fire load (#49)</b>	
	Tim Krause, Jens Brunzendorf, Detlev Markus, Harun Kanbur, Niels Springer, Otto Walch, Christian Herr	Martin Kluge, Abdel Karim Habib, Kees van Wingerden	
14:30	<b>A comparative study between two ignition sources: electric igniter versus pyrotechnic igniter (#30)</b>	<b>Experimental investigation into the consequences of release of liquified hydrogen onto and under water (#50)</b>	
	Stephane Bernard, Chayma El Gadha, Mame William Louis	Martin Kluge, Abdel Karim Habib, Kees van Wingerden	
15:00	<b>Measurement of dust flame propagation and temperature with low wall influence (#37)</b>	<b>Minimum diameters for CH<sub>4</sub>/H<sub>2</sub>-air mixtures: implications for natural gas cooktop burners (#57)</b>	
	Christoph Spijker, Stefan Puttinger, Simon Schneiderbauer, Stefan Pirker, Georg Meyer, Christoph Buchner, Tino Lindner-Silwester	Cristian Mejía-Botero, Josué Melguizo-Gavilanes, Fernando Veiga-López	
15:30 - 16:00	<b>Coffee break</b>		

Monday, July 11			
Room	Lecture Hall	Room A	Room B
16:00 - 17:30	<b>Session 5 Explosion prevention I</b>	<b>Session 6 Dust explosions I</b>	<b>Free</b>
<b>Chair</b>	Ritsu Dobashi	Maria Portarapillo	
16:00	<b>Experimental study of humidity influence on triboelectric charging of particle-laden duct flows (#15)</b>	<b>Classification of Dispersibility for Combustible Dust based on Hausner Ratio (#11)</b> <b>Online presentation</b>	
	Holger Grosshans, Wenchao Xu	Yajie Bu, Albert Addo, Paul Amyotte, Yuan Chunmiao	
16:30	<b>Assessment of explosion risks caused by cone discharges when filling silos and containers with pellets (#46)</b>	<b>Moderation of Fe dust explosion by nano-sized Fe<sub>2</sub>O<sub>3</sub> and Fe<sub>3</sub>O<sub>4</sub> powders (#60)</b>	
	Martin Glor, Ute Hesener	Yongzheng Guo, Kaiyue Ren, Peng Zhao, Weixing Huang, Aizhu Wei, Dejian Wu	
17:00	<b>Review on CFD modeling of electrostatic powder charging during pneumatic conveying (#84)</b>	<b>Dust cloud behaviour in the modified Hartmann tube (#88)</b>	
	Holger Grosshans, Simon Jantac	Enrico Danzi, Olivier Dufaud, Fausto Franchini, Luca Marmo, Matteo Pietraccini	

Monday, July 11	
<b>Room</b>	<b>PTB Canteen</b>
<b>17:45</b> - <b>19:45</b>	<b>Welcome reception</b>
<b>20:00</b>	<b>Shuttle Busses to the hotels leave at PTB Seminar Centre</b>

<b>Tuesday, July 12</b>	
08:20	Shuttle Busses to PTB leave at the hotels
<b>Room</b>	<b>PTB Seminar Centre</b>
<b>08:30</b> - <b>09:00</b>	<b>Registration</b>
<b>Room</b>	<b>Lecture Hall</b>
<b>09:00</b> - <b>10:30</b>	<b>Rolf K. Eckhoff Memorial Session</b>
<b>Chair</b>	Ulrich Krause
<b>09:00</b>	<b>Rolf K. Eckhoff in memoriam</b>
	Trygve Skjold
<b>09:30</b>	<b>Aerosol explosion: hybrids and what else?</b>
	Olivier Dufaud Université de Lorraine
<b>10:45</b> - <b>11:15</b>	<b>Coffee break</b>

**Tuesday, July 12**

Room	Lecture Hall	Room A	Room B
11:15 - 12:45	<b>Session 7</b> Explosion modelling and simulation II	<b>Session 8</b> Explosion prevention II	Free
<b>Chair</b>	Trygve Skjold	Hannes Kern	
11:15	<b>A CFD Based Methodology to Design an Explosion Prevention System For Li-Ion Based Battery Energy Storage System (#71)</b>	<b>Inert gas influence on limiting experimental safe gap of fuel-air mixtures at various initial pressures (#9)</b>	
	Anil Kapahi Kapahi, Sunil Lakshmiathy, Stefan Kraft, Jens Conzen, Alberto Alvarez-Rodriguez	Maria Mitu, Sabine Zakel, Thomas Stolz	
11:45	<b>Modelling Methodology for Deflagration Vent Design of Battery Energy Storage Systems (#73)</b>	<b>Study on the mechanism of methane combustion near flammability limits at high pressures and temperatures (#13)</b> <b>cancelled</b>	
	Sunil Lakshmiathy, Anil Kapahi Kapahi, Jerome Taveau, Stefan Kraft, Jens Conzen	Pengliang Li, Zhenyi Liu	
12:15	<b>Probabilistic Risk Assessment for domino effect due to Vapor Cloud Explosions using an integrated Petri-Bayesian network approach (#93)</b>	<b>The capabilities of flame arresters on explosive mixtures with increased inert gas content (#43)</b>	
	Julio Ariel Dueñas Santana, Orelvis González Gómez, Jesus Luis Orozco	Frank Stolpe, Samah Bendada	
12:45 - 14:00	<b>Lunch break</b>		



**Tuesday, July 12**

<b>Room</b>	<b>Lecture Hall</b>	<b>Room A</b>	<b>Room B</b>
<b>14:00</b> - <b>15:30</b>	<b>Session 10</b> Explosion modelling and simulation III	<b>Session 21 (ISSA)</b> Explosion Prevention – Safe technology is not enough – Personal competence is mandatory	<b>Session 9</b> Explosion-protected devices I
<b>Chair</b>	Lorenz Boeck	Thomas Köhler President of ISSA Chemistry Section	Jérôme Taveau
<b>14:00</b>	<b>Dust Particle Sedimentation in the 20 L Standard Vessel for Dust Explosion Tests (#25)</b>	<b>Equipment in hazardous areas – Can it be purchased and operated safely without competence?</b>	<b>Thermal evaluation of junction and connection boxes in explosion protection (#7)</b>
	Maria Portarapillo, Almerinda Di Benedetto, Marco Trofa, Roberto Sanchirico	Michael Mayer, AZO GmbH & Co. KG Marc Scheid, FireEx Consultant GmbH	Florian Koch, Detlev Markus, Ulrich Krause, Peter Thurnherr
<b>14:30</b>	<b>Improved modelling of hydrogen explosions – representing effects of varying concentration and reduced oxygen atmospheres (#64)</b>	<b>Necessary personal competence throughout the life cycle of an explosion-protected system</b>	<b>Analysis of flanged joints for flameproof enclosed devices of gas group IIC according to the standard IEC 60079-1 (#24)</b>
	Melodía Lucas, Helene Hisken, Trygve Skjold, Bjørn Arntzen	Marc Scheid, FireEx Consultant GmbH Michael Mayer, AZO GmbH & Co. KG	Victor Hugo Padron Herrera
<b>15:00</b>	<b>Characterizing the Reactivity of Large-Scale Explosions Using a Dimensionless Two-Parameter Combustion Model (#70)</b>	<b>Hazard assessment and concept for explosion prevention: Issues of implementation in Austria</b>	<b>An experimental and a numerical study of a vented dust explosion in an 11.5 m3 vessel (#38)</b>
	Regis Bauwens, Lorenz Boeck, Sergey Dorofeev	Klaus Kopia Allgemeine Unfallversicherungsanstalt - AUVA	Chen Huang Huang
<b>15:30</b> - <b>16:00</b>	<b>Coffee break</b>		

**Tuesday, July 12**

Room	Lecture Hall	Room A	Room B
16:00 - 17:30	Session 11 and 12 Hydrogen safety II and Hybrid mixture explosions I	Session 22 (ISSA) Explosion Prevention – safe technology is not enough – personal competence is mandatory	free
Chair	Sabine Zakel	Michel Pourquet & Martin Gschwind	
16:00	Experimental study of Unconfined Lean Hydrogen-Oxygen Explosions (#54) <b>(shifted to Thursday Session 23)</b>	Overall concept for qualifi-cation in explosion prevention: implementation in France	
	Tomoyuki Johzaki, Takuma Endo, Wookyung Kim, Keita Tanaka, Akihiro Ueda, Yangkyun Kim	Aline Mardirossian Institut National de Recherche et de Sécurité - INRS	
16:30	The role of vapor fraction in hydrocarbon mist explosion (#68)	Introduction to the panel discussion Michel Pourquet Vice President of ISSA Chemistry Section	
	Stéphanie El-Zahlanieh, Amelie Jean, Alexis Vignes, Olivier Dufaud	Panel discussion: Qualification in Explosion Protection - different national ways – advantages and issues	
17:00	Where one plus one equals three: the MIT of hybrid mixtures (#17)	Michael Mayer, Marc Scheid, Klaus Kopia, Aline Mardirossian, Martine Bloch, Oswald Losert, Martin Gschwind	
	Paul Geoerg, Stefan Spitzer, Dieter Gabel, Ulrich Krause	Conclusion and summary Martin Gschwind Vice President of ISSA Chemistry Section	
17:45	Shuttle Busses to the hotels leave at PTB Seminar Centre		

**Tuesday, July 12**

<b>Room</b>	<b>Young researcher's night</b>	<b>IOC Meeting</b>
<b>19:00 - 21:30</b>	for student researchers by personal invitation	by personal invitation

<b>Wednesday, July 13</b>	
08:20	Shuttle Busses to PTB leave at the hotels
<b>Room</b>	<b>PTB Seminar Centre</b>
<b>08:30</b> - <b>09:00</b>	<b>Registration</b>
<b>Room</b>	<b>Lecture Hall</b>
<b>09:00</b> - <b>10:00</b>	<b>Plenary Session</b>
<b>Chair</b>	Detlev Markus
<b>09:00</b> - <b>10:00</b>	<b>Industrial loss prevention relies on science</b> How fundamental explosion research is translated into loss prevention guidance at FM Global
	Lorenz R. Boeck FM Global
<b>10:00</b> - <b>10:45</b>	<b>Coffee break</b> (Symposium Group Foto)

**Wednesday, July 13**

<b>Room</b>	<b>Lecture Hall and Room A, B, Foyer</b>
<b>10:45</b> - <b>12:45</b>	<b>Session "Industry meets science"</b>
<b>Chair</b>	Detlev Markus
<b>10:45</b> - <b>11:15</b>	<b>Discussion of the key challenges at thematic panels</b> The five key challenges are: 'Machine learning / AI / Digitalization', 'Combustion science', 'Numerical simulation', 'Societal and regulatory requirements', and 'Going green'
	Stefan Essmann, Tim Krause, Holger Großhans, Simon Jantac, Wenchao Xu (Seminar Centre at different places)
<b>11:15</b> - <b>12:45</b>	<b>Panel discussion</b> <ul style="list-style-type: none"><li>• Summary of the results of the thematic panels by the thematic panel chairs</li><li>• Questions from the panels</li><li>• Questions from the audience</li></ul>
	Lorenz Boeck, FM Global Malte Gerhold, Bayer AG Stefan Grund, BGN Vera Hoferichter, BASF SE Oswald Losert, BG RCI
<b>12:45</b> - <b>13:15</b>	<b>Lunch break</b> (Please take packed lunches and go to the open air test site.)

**Wednesday, July 13**

<b>Room</b>	<b>PTB open-air test site</b>
<b>13:15</b> - <b>14:15</b>	<b>Demonstration of large-scale experiments</b>
<b>Chair</b>	Frank Stolpe
14:25	Shuttle Busses to Braunschweig City leave at PTB campus close to the test site
<b>15:00</b> - <b>16:45</b>	<b>Guided City Tour</b>
<b>Chair</b>	Carola Schierding
<b>16:45</b> - <b>17:45</b>	<b>Free time in the city center</b>
17:45	Shuttle Busses to PTB leave at the hotels
<b>18:15</b> - <b>21:45</b>	<b>Barbeque</b>
22:00	Shuttle Busses to the hotels leave at PTB Entrance

<b>Thursday, July 14</b>	
08:20	Shuttle Busses to PTB leave at the hotels
<b>Room</b>	<b>PTB Seminar Centre</b>
<b>08:30</b> - <b>09:00</b>	<b>Registration</b>
<b>Room</b>	<b>Lecture Hall</b>
<b>09:00</b> - <b>10:00</b>	<b>Plenary Session</b>
<b>Chair</b>	Holger Großhans
<b>09:00</b> - <b>10:00</b>	<b>Progress of hybrid mixture explosions:</b> From safety characteristics, explosion criteria to explosion regimes
	Dejian Wu Bundesanstalt für Materialforschung und -prüfung (formerly Sichuan University)
<b>10:00</b> - <b>10:45</b>	<b>Coffee break</b>

**Thursday, July 14**

Room	Lecture Hall	Room A	Room B
<b>10:45 - 12:45</b>	<b>Session 13 Dust Explosions II</b>	<b>Session 14 Hydrogen Safety III</b>	<b>Session 23 Explosion modelling and experiments I Additional Session</b>
<b>Chair</b>	Chris Cloney	Stefan Essmann	Bo Shu
<b>10:45</b>	<b>Dust Explosions in Vessel-Pipe Systems at Large Scale (#16)</b>	<b>Schlieren imaging investigations of hot gas kernel expansion caused by slow contact-break discharges (#3)</b>	<b>Experimental study of Unconfined Lean Hydrogen-Oxygen Explosions (#54) Online presentation (shifted from Session 6)</b>
	Lorenz Boeck, Regis Bauwens, Sergey Dorofeev	Carsten Uber, Steffen Franke, Michael Hilbert, Dirk Uhrland, Niklas Schüler	Tomoyuki Johzaki, Takuma Endo, Wookyung Kim, Keita Tanaka, Akihiro Ueda, Yangkyun Kim
<b>11:15</b>	<b>Thermal Structure of Aluminum Dust Explosion with Additional Carbon Dioxide (#26)</b>	<b>Investigating the influence of additional inductivity in electrical circuits during ignition caused by contact break discharges (#4)</b>	<b>CFD modelling of vented explosions for chambers of two different scales (#51) Additional presentation</b>
	Pojul Chang, Toshio Mogi, Ritsu Dobashi	Bogdan Barbu, Carsten Uber, Frank Berger, Michael Hilbert	Guillaume Lecocq, Jérôme Daubech, Emmanuel Leprette
<b>11:45</b>	<b>Ageing Effect on Ignition Sensitivity of Lignocellulosic Dusts (#59)</b>	<b>Investigation of the safety related ignition processes of laminar strained premixed NH<sub>3</sub>-H<sub>2</sub>-air flames (#67)</b>	<b>Experimental and numerical study of the fuel effect on flame propagation in long open tubes (#52) Additional presentation</b>
	Maria Portarapillo, Almerinda Di Benedetto, Roberto Sanchirico, Enrico Danzi, Luca Marmo	Chunkan Yu, Detlev Markus, Robert Schießl, Ulrich Maas, Bo Shu, Sven Eckart, Harmut Krause, Stefan Essmann, Agustin Valera-Medina	Guillaume Lecocq, Jérôme Daubech, Emmanuel Leprette
<b>12:15</b>	<b>Recycling of plastics: dust explosion risk evaluation (#61)</b>	<b>Experimental and numerical modelling of igniting hydrogen/air mixtures in inter-connected vessels (#74)</b>	<b>A Numerical Model for the Minimum Ignition Temperature of Dust Clouds (#53) Online presentation (postponed from session 2)</b>
	Enrico Danzi, Luca Marmo, Maria Portarapillo, Roberto Sanchirico, Almerinda Di Benedetto	Bisham McCarthy-Singh, Tim Krause, Detlev Markus, Holger Grosshans, Manideep Manchikatla, Alberto Gambarato	Tengfei Chen, Jo van Caneghem, Jan Degrève, Jan Berghmans, Filip Verplaetsen, Maarten Vanierschot



Thursday, July 14	
12:45 - 13:45	Lunch break
Room	PTB Campus - Starts and ends in Seminar Centre
13:45 - 15:30	PTB Lab tour
Chair	Michael Hilbert
13:45 - 14:00	<b>Organization time - formation of the groups</b> You have received a colored card with a number and a letter for the group membership.
14:00	Lab 1
14:30	Lab 2
15:00	Lab 3
15:30 - 16:00	Coffee break

Thursday, July 14			
Room	Lecture Hall	Room A	Room B
16:00 - 17:30	<b>Session 15</b> Flame propagation and acceleration I	<b>Session 16</b> Explosion prevention III	<b>Session 17</b> Dust Explosions III
<b>Chair</b>	Arnas Lucassen	Paul Amyotte	Dejian Wu
16:00	<b>Research on the flame stability of biodiesel/diesel blends in small-scale combustion based on data fusion (#21)</b>	<b>Explosive properties of selected aerosols determined in the spherical 5 l test chamber (#45)</b>	<b>Investigation of Marginally Explosible Dusts (#10)</b>
	Gongping Mao, Huan Mao, Zhijian Xu, Chunkan Yu, <del>Ulrich Maas</del>	Adrian Toman, Wojciech Adamus	Albert Addo, Maria Portarapillo, Almerinda Di Benedetto, Yajie Bu, Paul Amyotte, Yuan Chunmiao, Ashok Dastidar, Faisal Khan
16:30	<b>Influence of the flammable cloud geometry on the gas explosion effects (#65)</b>	<b>Holi powder potential dust explosions (#33)</b>	<b>Turbulence generated by dust dispersion in the standard 1 m3 vessel (#72)</b>
	Jérôme Daubech, Jérôme Hébrard, Emmanuel Leprette	Blanca Castells, Isabel Amez, Javier Garcia-Torrent, David León	Zdzisław Dyduch
17:15	Shuttle Busses to the hotels leave at PTB Seminar Centre		

**Thursday, July 14**

<b>Room</b>	<b>Braunschweig City, Old Town Hall</b>
<b>19:30</b> - <b>21:45</b>	<b>Reception and conference banquet</b> At the invitation of Braunschweig, the City of Science, the Physikalisch-Technische Bundesanstalt (PTB) as the National Metrology Institute of Germany and the Helmholtz-Fonds e. V. starting with official words of welcome (Please keep your invitation card at hand for your admission to the reception. Please be aware that T-shirts, shorts, and sandals are inappropriate for this event.)

<b>Friday, July 15</b>	
08:20	Shuttle Busses to PTB leave at the hotels
<b>Room</b>	<b>PTB Seminar Centre</b>
08:30 - 09:00	Registration
<b>Room</b>	<b>Room A</b>
09:00 - 10:30	Work-in-progress Poster Session
<b>Chair</b>	Tim Krause
10:30 - 11:15	Coffee break

Friday, July 15

Room	Lecture Hall	Room A	Room B
<b>11:15 - 12:45</b>	<b>Session 18 Case studies I</b>	<b>Session 20 Ignition phenomena I</b>	<b>Session 19 Hybrid mixture explosions II</b>
<b>Chair</b>	Oswald Losert	Michael Hilbert	Enrico Danzi
<b>11:15</b>	<b>Qualification in explosion protection - use of an adaptive learning platform (#28)</b>	<b>Experimental study on inert products, moisture, and particle size effect on the minimum ignition energy of combustible dusts (#32)</b>	<b>The maximum rate of pressure rise of hybrid mixtures (#5)</b>
	Patrick Dyrba	Isabel Amez, Blanca Castells, David León, Javier Garcia-Torrent, Ljiljana Medic	Stefan Spitzer, Enis Askar, Paul Geoerg, Dieter Gabel, Arne Krietsch, Ulrich Krause
<b>11:45</b>	<b>High-surface area oxidation: can it also happen in my plant? (#6)</b>	<b>Thermal Ignition: Effects of Fuel, Ambient Pressure and Nitrogen Dilution (#48)</b>	<b>1st International Round Robin Test on Safety Characteristics of Hybrid Mixtures (#18)</b>
	Bart Dervaux	Conor Martin, Joseph Shepherd	Stefan Spitzer, Arne Krietsch
<b>12:15</b>	<b>Learning From the Past: the Importance of Risk Assessment in Aluminium Dust Processes (#41)</b>	<b>Ignition energy and flame propagation in ethylene oxide- air mixtures (#85)</b>	<b>Making hybrid mixtures explosion a common case (#77)</b>
	Marco Barozzi, Marco Derudi, Martina Silvia Scotton, Sabrina Copelli	Christophe Proust	Matteo Pietraccini, Pierre-Alexandre Glaude, Anthony Dufour, Olivier Dufaud

**Friday, July 15**

<b>Room</b>	<b>PTB Seminar Centre</b>
<b>12:45</b> - <b>15:00</b>	<b>Farewell Reception</b>
<b>Chair</b>	Michael Beyer
<b>13:00</b>	<b>Lunch</b>
	Foyer of the Seminar Centre
<b>13:45</b>	<b>Best Paper Awards</b>
	Award Committee
<b>14:15</b>	<b>Closing</b>
	Michael Beyer
15:15	Shuttle Busses to the hotels leave at PTB Seminar Centre