

Looking for the minimum efficiency of fibrous air filters during their service life

Original

Looking for the minimum efficiency of fibrous air filters during their service life / Tronville, PAOLO MARIA; Rivers, R.. - STAMPA. - 1:(2012), pp. 57-57. (Intervento presentato al convegno 11th World Filtration Congress & Exhibition tenutosi a Graz - Austria nel April 16-20, 2012).

Availability:

This version is available at: 11583/2506478 since:

Publisher:

Filtech Exhibitions Germany

Published

DOI:

Terms of use:

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

Publisher copyright

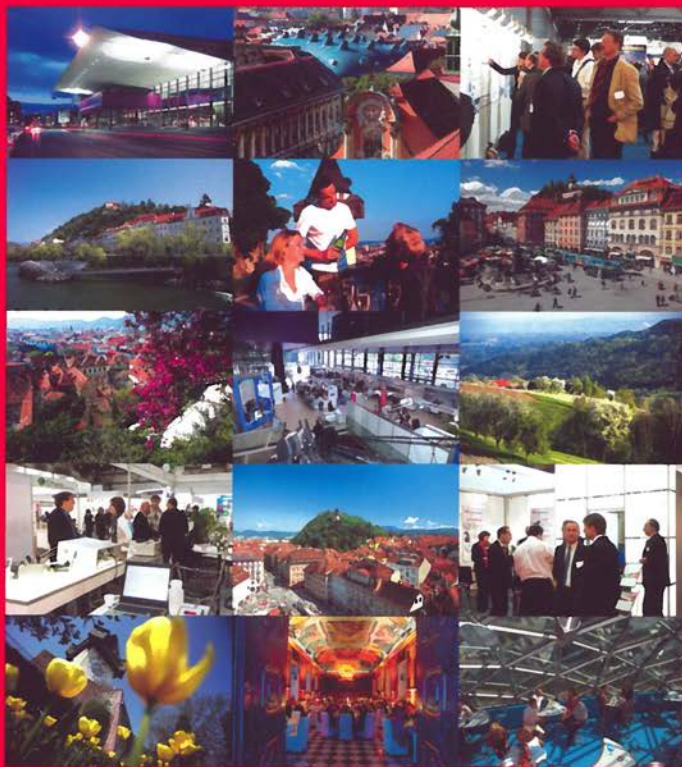
(Article begins on next page)

11th World Filtration Congress & Exhibition

hosted by

The Austrian Chemical Society GÖCH

April 16 - 20, 2012 – Graz – Austria



Abstract Book



WFC11

11th World Filtration Congress

Abstract Book

CONTENT VOLUME I

Scientific Committee	4
Page Indicator & Session Chairmen	5
Plenary Lecture	10
Keynote Lectures	11
Papers G-Sessions	15
Papers L-Sessions	99
Papers M-Sessions	174
Keyword List (Page Indicator)	327

Conference Dates:

April 16 – 20, 2012

Venue:

Messe Congress Graz · Messeplatz 1 · 8010 Graz · Austria

hosted by

GÖCH – Austrian Chemical Society

www.goech.at

WFC11 Congress Organizing Secretariat:

Filtech Exhibitions Germany

PO Box 1225 · 40637 Meerbusch – Germany

phone: +49 (0) 2132 93 57 60

fax: +49 (0) 2132 93 57 62

e-mail: Info@wfc11.at

web: www.wfc11.at

Abstract Book
USB-Stick

ISBN 978-3-941655-04-1
ISBN 978-3-941655-05-8

SCIENTIFIC COMMITTEE CHAIRMEN

■ Prof. Wilhelm Höflinger

Vienna University of Technology, Austria

■ Prof. Gerd Mauschitz

 Vienna University of Technology, Austria

SCIENTIFIC COMMITTEE

- Dr. Harald Anlauf, Karlsruhe Institute of Technology, Germany
- Prof. Jan Baeyens, University of Warwick, Great Britain
- Dr. Roger BenAim, Scientific Advisor IFTS, France
- Prof. Rolf Berndt, RBFM Consulting, Germany
- Dr. Reinhard Bott, Bokela, Germany
- Dr. Roger de Bruyne, Belgium
- Prof. George Chase, University of Akron, USA
- Prof. Liang-Yin Chu, Sichuan University, P.R. China
- Prof. Ching-Jung Chuang, Chung Yuan University, Taiwan
- Prof. José Coury, Federal University of Sao Carlos, Brazil
- Prof. Enrico Drioli, University of Calabria, Italy
- Ulrich Esser, Bayer, Germany
- Prof. Anton Friedl, Vienna University of Technology, Austria
- Prof. Rolf Gimbel, IWW, Germany
- Prof. Nigel Graham, Imperial College London, Great Britain
- Prof. Michael Harasek, Vienna University of Technology, Austria
- Dr. Haio Harms, Lenzing, Austria
- Lloyd Holliday, Outotec, Great Britain
- Prof. Kuo-Jen Hwang, Tamkang University, Taiwan
- Prof. Eiji Iritani, Nagoya University, Japan
- Dr. Tadeusz Jaroszczyk, USA
- Prof. Chikao Kanaoka, National College of Technology, Japan
- Prof. Gerhard Kasper, Karlsruhe Institute of Technology, Germany
- Prof. Esko Kauppinen, VTT Processes, Finland
- Prof. Kristian Keiding, Aalborg University, Denmark
- Ir. Hermanes H. Kleizen, Dutchap bv, Netherlands
- Prof. Gernot Krammer, Andritz, Austria
- Dr. Thomas Langeloh, Bokela, Germany
- Prof. Markus Lehner, Montanuniversität Leoben, Austria
- Prof. Dietmar Lerche, L.U.M., Germany
- Prof. Wallace Leung, The Hong Kong Polytechnic University, P.R. China
- Prof. Andrew Livingston, Imperial College London, Great Britain
- Prof. Richard Lydon, Clear Edge Group, Great Britain
- Prof. Ingo Marini, Vienna University of Technology, Austria
- Prof. Petr Mikulasek, University of Pardubice, Czech Republic
- Prof. Karoly Molnar, Budapest University, Hungary
- Prof. Hermann Nirschl, Karlsruhe Institute of Technology, Germany
- Prof. Marianne Nyström, Lappeenranta University of Technology, Finland
- Dr. Dietmar Oechsle, EBG Innowa, Germany
- Dr. Thomas Peters, Consulting, Germany
- Dr. Christophe Peuchot, I.F.T.S., France
- Prof. Urs Peuker, Technical University of Freiberg, Germany
- Dr. Jaroslav Pridal, Mikropur, Czech Republic
- Dr. Graham Rideal, Whitehouse Scientific, Great Britain
- Prof. Siegfried Ripperger, Technical University of Kaiserslautern, Germany
- Prof. Wolfgang Samhaber, Johannes Kepler University Linz, Austria
- Prof. Peter Scales, University of Melbourne, Australia
- Prof. Hans-Joachim Schmid, University of Paderborn, Germany
- Prof. Eberhard Schmidt, University of Wuppertal, Germany
- Prof. Radmila Secerov Sokolovic, University of Novi Sad, Serbia
- Prof. Peter Stelter, Heinkel Process Technology, Germany
- Dr. Steve Tarleton, Loughborough University, Great Britain
- Prof. Hans Theliander, Chalmers University, Sweden
- Prof. Chi Tien, Syracuse University, USA
- Prof. Paolo Tronville, Politecnico di Torino, Italy
- Dr. Barry Verdegan, Cummins Filtration, USA
- Dr. Jean-Francois Vicard, Stratene, France
- Prof. Eugène Vorobiev, Technical University of Compiègne, France
- Dr. Matthias Waldenmaier, Freudenberg Filtration Technologies, Germany
- Prof. Stanislaw Wronski, Warsaw University of Technology, Poland
- Prof. Nanping Xu, Nanjing University, P.R. China
- Prof. Yang Zhao, Hefei General Machinery Research Institute, P.R. China

PAGE INDICATOR AND SESSION CHAIRMEN

TUESDAY, APRIL 17, 2012

	Time	Page
Plenary Lecture - Evolution in Separation – Technical development by mutation and selection Dr. Harald Anlauf, Karlsruhe Institute of Technology (KIT) - Germany	11:00-12:00 h	10
L1 - SLS-Fundamentals I Session Chair: Richard Wakeman	13:15-14:30 h	99
L2 - Filter Media I Session Chair: Richard P. Lydon	13:15-14:30 h	102
L3 - SLS Adsorptive Separations Session Chair: Gernot Krammer	13:15-14:30 h	105
M1 - Modelling Membrane Processes Session Chair: Kuo-Jen Hwang	13:15-14:30 h	174
M2 - Application of Membranes I Session Chair: Jaroslav Pridal	13:15-14:30 h	177
Key-Note 1 - Fine particle emissions from pulse-cleaned Filters · Prof. Gerhard Kasper, Karlsruhe Institute of Technology (KIT) - Germany, Session Chair: Eberhard Schmidt	13:15-14:30 h	11
L4 - SLS-Fundamentals II Session Chair: Stephen Tarleton	15:00-16:15 h	108
L5 - Water and Waste Water I Session Chair: Gernot Krammer	15:00-16:15 h	111
Key-Note 2 - Geomimetic membrane: A new route to develop novel inorganic membranes · Prof. Kuo-Lun Tung - Chung, Yuan University - Taiwan, Session Chair: Siegfried Ripperger	15:00-16:15 h	12
G1 - Gas Filtration Fundamentals I Session Chair: Gerhard Kasper	15:00-16:15 h	15
G2 - Nanoparticle & Depth Filtration I Session Chair: Leon Gradon	15:00-16:15 h	18
G3 - Cyclone I Session Chair: Steffen Schütz	15:00-16:15 h	21
L6 - SLS-Filter Testing I Session Chair: Kristian Keidiing	16:45-18:25 h	113
L7 - Centrifugal SLS Session Chair: Thomas Langeloh	16:45-18:25 h	117
M3 - New Membranes & Materials I Session Chair: Kuo-Jen Hwang	16:45-18:25 h	180
M4 - Crossflow Processes Session Chair: Siegfried Ripperger	16:45-18:25 h	184
G5 - Nanoparticle & Depth Filtration II Session Chair: MARKUS Lehner	16:45-18:25 h	24
G6 - Cyclone II Session Chair: Arunangshu Mukhopadhyay	16:45-18:00 h	28

WEDNESDAY, APRIL 18, 2012

	Time	Page
L8 - SLS-Fundamentals III Session Chair: Christian Keiding	09:00-10:15 h	121
L9 - Filtration Post-Treatment & Filter Aids Session Chair: Reinhard Bott	09:00-10:15 h	124
M5 - New Membranes & Materials II Session Chair: Wolfgang Samhaber	09:00-10:15 h	188
M6 - Water Treatment I Session Chair: Ching-Jung Chuang	09:00-10:15 h	191
G7 - Cleanable Dust Filtration I Session Chair: Eberhard Schmidt	09:00-10:15 h	31
G8 - Nanoparticle & Depth Filtration III Session Chair: Leon Gradon	09:00-10:15 h	34
G9 - Heating, Ventilating, Air Conditioning (HVAC) Session Chair: Markus Lehner	09:00-10:15 h	37
PL1 - Solid-Liquid Separation I Session Chair: Harald Anlauf	10:45-12:00 h Discussion at the Poster Area 12:00 –12:45	254
PL2 - Solid-Liquid Separation II Session Chair: Eugène Vorobiev	10:45-12:00 h Discussion at the Poster Area 12:00 –12:45	264
PM1 - Membrane Separation I Session Chair: Herrmann Nirschl	10:45-12:00 h Discussion at the Poster Area 12:00 –12:45	294
PM2 - Membrane Separation II Session Chair: Thomas Peters	10:45-12:00 h Discussion at the Poster Area 12:00 –12:45	301
PG1 - Solid Gas Separation I Session Chair: Markus Lehner	10:45-12:00 h Discussion at the Poster Area 12:00 –12:45	232
PG2 - Solid Gas Separation II Session Chair: Wallace Woon-Fon Leung	10:45-12:00 h Discussion at the Poster Area 12:00 –12:45	239
G10 - Cleanable Dust Filtration II Session Chair: Leon Gradon	10:45-12:00 h	40
Key-Note 3 - Separation challenges for the biotechnology: SMART is one answer · Dr. Kasten Keller - Solae/Dupont - USA, Session Chair: Richard Wakeman	14:00-15:15 h	13
M7 - New Membranes & Materials III Session Chair: Allan Kuo-Lun Tung	14:00-15:15 h	194
M8 - Water Treatment II Session Chair: Dietmar Oechsle	14:00-15:15 h	197
G11 - Cleanable Dust Filtration III Session Chair: Gerd Mauschitz	14:00-15:15 h	43
G12 - Mist Droplet Separation I Session Chair: Hans-Joachim Schmid	14:00-15:15 h	45
G13 - Filter Testing I Session Chair: Christophe Peuchot	14:00-15:15 h	48

WEDNESDAY, APRIL 18, 2012

	Time	Page
L10 - Vacuum & Pressure Filter I Session Chair: Ulrich Esser	15:45-17:25 h	127
L11 - Force Enhanced Solid Liquid Separation Session Chair: Eiji Iritani	15:45-17:25 h	131
M9 - New Membranes & Materials IV Session Chair: Dietmar Oechsle	15:45-17:25 h	200
M10 - Membrane Special Applications Session Chair: Michael Harasek	15:45-17:25 h	204
G14 - Electrostatic & Wet Separators Session Chair: Gerd Mauschitz	15:45-17:25 h	51
G15 - Mist Droplet Separation II Session Chair: Sunil Sharma	15:45-16:40 h	55
G16 - Filter Testing II Session Chair: Gerd Mauschitz	15:45-16:40 h	57

THURSDAY, APRIL 19, 2012

	Time	Page
L12 - Vacuum and Pressure Filter II Session Chair: Urs Peuker	09:00-10:15 h	135
L13 - Chemical Enhanced Solid Liquid Separation Session Chair: Christophe Peuchot	09:00-10:15 h	138
M11 - Membrane Fouling I Session Chair: Radmila Secerov Sokolovic	09:00-10:15 h	208
M12 - Membrane Bioreactor Session Chair: Liang-Yin Chu	09:00-10:15 h	211
G17 - Baghouse Filters I Session Chair: Sunil Sharma	09:00-10:15 h	59
G18 - Filter Media I Session Chair: Martin Lehmann	09:00-10:15 h	62
G19 - Filter Testing III Session Chair: Paolo Tronville	09:00-10:15 h	65
PL3 - Solid-Liquid Separation III Session Chair: Urs Peuker	10:45-12:00 h	272
PL4 - Solid-Liquid Separation IV Session Chair: Hermann Nirschl	10:45-12:00 h	282

THURSDAY, APRIL 19, 2012

	Time	Page
PM3 - Membrane Separation III Session Chair: Liang-Yin Chu	10:45-12:00 h	309
PM4 - Membrane Separation IV Session Chair: Michael Harasek	10:45-12:00 h	318
PG3 - Solid Gas Separation III Session Chair: Wilhelm Höflinger	10:45-12:00 h	246
G20 - Baghouse Filters II Session Chair: Hans-Joachim Schmid	10:45-12:00 h	68
G21 - Simulation of Filtration Processes I Session Chair: Martin Lehmann	10:45-12:00 h	71
L14 - Pretreatment Session Chair: Wallace Woon-Fon Leung	14:00-15:40 h	141
L15 - SLS Applications & New Processes Session Chair: Lloyd Holliday	14:00-15:40 h	145
L16 - SLS-Fundamentals IV Session Chair: Anthony Stickland	14:00-15:40 h	147
M13 - Dynamic Filtration Session Chair: Wolfgang Samhaber	14:00-15:40 h	213
M14 - Membrane Bioreactor & Water Treatment Session Chair: Eugène Vorobiev	14:00-15:40 h	216
Key-Note 4 - Modelling and simulation of filtration processes - a practitioner's overview , Dr. Andreas Wiegmann - Fraunhofer Institute for Industrial Mathematics ITWM, Germany Session Chair: Martin Lehmann	14:00-15:40 h	14
L17 - SLS Filter Testing II Session Chair: Eiji Iritani	16:10-17:50 h	151
L18 - SLS Filtration Applications II Session Chair: Hans Theliander	16:10-17:25 h	155
L19 - Filter Media II Session Chair: Wallace Woon-Fon Leung	16:10-17:50 h	158
M15 - Membrane Fouling II Session Chair: Rolf Berndt	16:10-17:50 h	219
G22 - Baghouse Filters III Session Chair: Arunangshu Mukhopadhyay	16:10-17:25 h	74
G23 - Filter Media II Session Chair: Siegfried Ripperger	16:10-17:50 h	77
G24 - Simulation of Filtration Processes II Session Chair: Michael Harasek	16:10-17:50 h	81

FRIDAY, APRIL 20, 2012

	Time	Page
L21 - SLS Filtration Applications II Session Chair: Rolf Berndt	09:00-10:15 h	162
M16 - Application of Membranes II Session Chair: Ching-Jung Chuang	09:00-10:15 h	223
M17 - Enhanced Membrane Separation Session Chair: Jaroslav Pridal	09:00-10:15 h	226
G25 - Emissions Control I Session Chair: Wilhelm Höflinger	09:00-10:15 h	85
G27 - Pleated Filter Media I Session Chair: Paolo Tronville	09:00-10:15 h	88
L22 - SLS Filter Testing III Session Chair: Christophe Peuchot	10:45-12:00 h	165
L23 - Simulation and Scale-Up Session Chair: Thomas Langeloh	10:45-12:00 h	168
L24 - Water & Waste Water II Session Chair: Wallace Woon-Fon Leung	10:45-12:00 h	171
M18 - Water Treatment III Session Chair: Tung-Wen Cheng	10:45-12:00 h	229
G28 - Emission Control II Session Chair: Sunil Sharma	10:45-12:00 h	91
G29 - Filter Media III Session Chair: Paolo Tronville	10:45-12:00 h	94
G30 - Pleated Filter Media II Session Chair: Gerd Mauschitz	10:45-12:00 h	97

LOOKING FOR THE MINIMUM EFFICIENCY OF FIBROUS AIR FILTERS DURING THEIR SERVICE LIFE

Paolo Tronville, Politecnico di Torino - DENERG, Corso Duca degli Abruzzi 24,
+10129 Turin, Italy

Richard Rivers, EQS Inc., 1262 Bassett Avenue, Louisville, KY 40204, USA

ABSTRACT

Electret fibrous air filter media achieve high efficiencies while maintaining low air flow resistance by incorporating electrostatic charges on their fibers. However, captured ultrafine particles reduce this electrostatic enhancement. It is important to evaluate the behavior of such media when their electrostatic enhancement has been completely suppressed, leaving only "mechanical" effects such as sieving, impaction, interception and diffusion. Existing standards EN779:2002 and ASHRAE 52.2-2007 specify preconditioning procedures to eliminate or reduce electrostatic effects. ASHRAE 52.2 exposes the full air filter to KCl nanoparticle aerosols. ISO/TS 21220:2009 and EN 779 precondition filter media by a 2 minute soak in isopropyl alcohol (IPA), after which the filter media are dried before further efficiency measurement. These approaches present problems:

- To control the size distribution of KCl nanoparticles requires additional expensive equipment and, even after completing this procedure, the electrostatic charge can be still partly active.
- The structure of some media may be affected by immersion in liquid IPA.
- Soaking full scale air filters is not practical and requires large amounts of IPA, which is then dispersed into the environment.

The most recent efforts in getting the discharged efficiency of a filter have been made by ISO/TC142 "Cleaning equipment for air and other gases" Working Group 9, which is devoted at developing standards for gas turbine air intake applications.

A new procedure proposed by Hayashi (Japan) eliminates electrostatic effects by exposing filters to IPA vapor for 8 hours or longer. This procedure has been successfully duplicated by Cai (China), at the Politecnico di Torino and in other laboratories.

WG9 of ISO/TC142 organized inter-laboratory tests comparing IPA vapor treatment to liquid IPA immersion on samples of five media types.

The data obtained indicate that IPA vapor treatment can replace the immersion approach successfully. The main result of these tests was the adoption of IPA vapor treatment on a flat sheet of medium in ISO/FDIS 29461-1 "Air intake filter systems for rotary machinery -- Test methods -- Part 1: Static filter elements". The discharge of full scale filter elements is still under study.

We summarize all these studies, and describe the new test protocols that could be adopted by future national and international test methods. The results presented here could also be useful to evaluate the need for further research in this area.

KEYWORDS

Air Filters, Air Filter Media, Conditioning Agents, Intake Filters, Nonwovens, Filter Media Testing