

A **CHINACOAT** CONFERENCE
中国国际涂料展指定学术会议

18-19.11.2019 ● 上海新国际博览中心
Shanghai New International Expo Centre

高性能涂料

——定义新一代涂料解决方案

HIGH PERFORMANCE COATINGS

— Defining Next Generation of Coating Solutions

会议主席
Conference Chairman



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18.11.2019 (星期一 Monday)

08:30 - 09:15 与会者登记 Registration

第一节 SESSION I

09:15 - 10:15 **主席致辞 CHAIRMAN ADDRESS**
涂料与油漆技术全球趋势
Global Trends in Coatings and Paint Technologies

10:15 - 11:00 **论文 PAPER 1**
实现更好水性涂料润湿的不同方法
Different Approaches to Achieve a Better Wetting of Waterborne Coatings

11:00 - 11:45 **论文 PAPER 2**
基于纳米二氧化硅防污表面涂料
Silica Nanoparticle-Based Antifouling Surface Coatings

11:45 - 13:00 午餐 LUNCH

第二节 SESSION II

13:00 - 13:45 **论文 PAPER 3**
高性能涂料用创新湿气固化型乙烯基烷氧基硅烷聚合物
Innovative Moisture Curing Vinyl Alkoxysilane Polymer for High-Performance Coatings

13:45 - 14:30 **论文 PAPER 4**
如何做到的——水性双组份聚氨酯涂料理论与实践
How It Works: Waterborne 2K PU Coatings Theory & Practice

14:30 - 15:15 **论文 PAPER 5**
氟化聚合物(聚偏二氟乙烯)水性涂料
Fluoropolymer (PVDF)-Based Waterborne Coatings

15:15 - 15:30 茶歇 COFFEE BREAK

15:30 - 16:15 **论文 PAPER 6**
独特的无钴催化剂——用于改善氧化固化体系干燥时间及其他附加效益
Unique Cobalt-Free Catalyst for Improved Dry Times and Other Added Benefits in Oxidative Cured Systems

16:15 - 17:00 **论文 PAPER 7**
具有高抗菌功效的含铜玻璃陶瓷
Copper-Containing Glass Ceramic with High Antimicrobial Efficacy

17:00 - 17:15 讨论环节 Discussion Session

17:15 第一天完 End of Day 1



19.11.2019 (星期二 Tuesday)

12:30 - 13:00 与会者登记 Registration

第三节 SESSION III

13:00 - 13:45 **论文 PAPER 8**
欧盟汽车修补漆面漆 420g/L VOC 标准分析
Analysis of EU's 420 g/L VOC Limit for Car Refinish Topcoats

13:45 - 14:30 **论文 PAPER 9**
蓖麻油基涂料用树脂的制备和性能研究
Synthesis & Properties of Castor Oil-Based Resin for Coatings

14:30 - 15:15 **论文 PAPER 10**
钛白粉颜料对涂料光泽保持的多重效应
Multiple Effects of TiO₂ Pigment on Paint Gloss Retention

15:15 - 15:30 茶歇 COFFEE BREAK

第四节 SESSION IV

15:30 - 16:15 **论文 PAPER 11**
纳米透明功能涂料的发展
Development of Nanometer Transparent Functional Coatings

16:15 - 17:00 **论文 PAPER 12**
用于高性能聚氨酯涂料的新型异氰酸酯
New Isocyanate for High-Performance Polyurethane Coatings

17:00 - 17:15 讨论环节 Discussion Session

17:15 会议结束 End of Conference

* 论文演讲和讨论将以英语和普通话进行。All presentation of papers & discussion will be conducted in both English & Chinese (Putonghua).

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Prof. Jamil Baghdachi
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涂料与油漆技术全球趋势

Global Trends in Coatings and Paint Technologies

近年, 涂料、油漆和相关材料的全球趋势主要集中在两大领域: 高性能多功能涂料及环保材料与工艺。推动这些技术的动力来自它们的经济价值、技术效益及全球走向生产更安全产品和更环境友好等大势潮流, 同时亦助力开发高性能和高价值涂料材料。这些涂料不仅能作为保护和装饰性材料, 而且远远超越传统涂料定义。这种新开发类别包括高性能和多功能涂料, 低/零 VOC 超高固体和即备涂料、低能量固化涂料/自分层/超疏水/腐蚀传感涂料等。本论文将讨论高性能和高价值涂料的技术、性能和应用及未来趋势。

In recent years global trends in coatings, paints and related materials have been in two main areas of high-performance multifunctional coatings and environmentally friendly materials and processes. Driving forces for these technologies have been the recognition of their economic values, technical benefits and global desire to produce safer products and healthier environment. The result of such movements has been the development of high performance and high-valued coating materials. These coatings not only function as protective and decorative materials, they also push the high performance envelop well beyond traditional definition of coatings. Included in this class of new developments are high performance and multi-functional coatings, low/zero VOC super high solids and instant set coatings, low energy cured coatings, self-stratifying, superhydrophobic, and corrosion sensing coatings, etc. This presentation will discuss the technologies, properties, applications of high performance and high valued coatings and future trends.



Dr. Guillaume Jaunky
博士

毕克化学, 德国
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实现更好水性涂料润湿的不同方法

Different Approaches to Achieve a Better Wetting of Waterborne Coatings

涂料是多组分体系, 因此表面/界面对其品质有很大影响。表面缺陷经常在涂层施工期间和之后发生, 降低涂层光学性和保护基材能力; 最常见的缺陷是基材润湿性差、在非最佳流动下形成桔皮和凹坑现象; 影响这些缺陷的一个非常重要参数, 就是所涉及材料的表面张力。

润湿现象是关键点之一, 特别是在水性涂料中, 因为它们的表面张力较高, 所以使用适当的润湿剂变得至关重要。向涂层/空气或涂层/基材界面迁移并调整表面或界面张力的添加剂可改善润湿性。本论文中, 我们将讨论降低涂层表面张力的常规方法, 及通过亲水性添加剂增加下层涂层表面能量的第二种方法, 这对后续涂层的润湿具正面影响。

Coatings are multi-component systems and surfaces/interfaces have strong influence on their quality. Surface defects often occur during and after coating application, and degrade both optical properties of the coating and its ability to protect the substrate. Most common defects are poor substrate wetting, non-optimal flow (orange peel) and crater formation. One very significant parameter affecting all these defects is the surface tension of the involved materials.

The wetting phenomenon is one of the crucial points, especially in waterborne coatings, as their surface tension is higher. Consequently, using appropriate wetting agent becomes of utmost importance. Additives that migrate toward the coating/air or coating/substrate interface and tailor surface or interface tension can improve wetting. In this presentation, we will discuss both conventional route to decrease surface tension of coating to be applied, and a second route to increase surface energy of an underlying coating by hydrophilic additives, which positively affects wetting of subsequent coating layer.

论文 PAPER 1



杨丹博士 Dr. Dan Yang

博士后研究员, 澳大利亚卧龙岗大学, 澳大利亚
Post-doctoral Fellow,
University of Wollongong,
Australia

基于纳米二氧化硅防污表面涂料

Silica Nanoparticle-Based Antifouling Surface Coatings

传统抗菌策略重点是通过从表面涂料中释放有毒杀菌剂, 针对性杀死污垢物种。目前, 业界正在开发更环保防污涂料, 为表面提供更全面污垢保护, 而不依靠毒性机制。

采用超亲水材料制备的涂料, 由于在涂层界面处产生紧密结合的水层而显出其更有效的防污性能, 该水层能筑起一道物理和能量屏障, 防止微生物相互作用和附着。该项目使用纳米二氧化硅 (SiNP) 为低成本平台材料, 以用来制备亲水性防污涂料。

采用较大颗粒制备的涂料, 呈现增加的纳米级粗糙度并显示增强抗生物污垢性。使用亲水性两性离子化学物质配对表面形状效应, 可产生出色的抗污染性。该项目展示 SiNP 涂层材料的多功能性和可加工性, 并突出开发功能化 SiNP 薄膜的潜力, 可作广泛防污涂层应用。

Where traditional antimicrobial strategies have focused on targeted killing of fouling species through release of toxic biocides from surface coatings, more environmentally friendly antifouling coatings are being developed to provide surfaces with broad-spectrum fouling protection without relying on toxic mechanisms.

Coatings prepared from superhydrophilic materials show promising antifouling behavior due to a tightly as bound water layer generated at the coating interface. This hydration layer acts a physical and energetic barrier, preventing microbial interaction and attachment. This work describes the use of silica nanoparticles (SiNP) as a low-cost, platform material for preparation of hydrophilic antifouling coatings.

Coatings prepared from larger particles presented increased nano-scale roughness and showed improved resistance to biological fouling. Pairing surface topographic effects with hydrophilic zwitterionic chemistries resulted in exceptional fouling resistance. This work demonstrates versatility and processability of SiNP coating materials and highlights potential for further development of functionalised SiNP films for widespread antifouling coating applications.

论文 PAPER 2





Mr. Denis Heymans
先生

高级技术主管，瀚森，比利时
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高性能涂料用创新湿气固化型乙烯基烷氧基硅烷聚合物

Innovative Moisture Curing Vinyl Alkoxysilane Polymer for High-Performance Coatings

论文 PAPER 3

在海洋和防护涂料应用中，湿气固化的烷氧基硅烷树脂被越来越多用作不含异氰酸酯的替代品。与双组分聚氨酯类似，这些体系根据其不同结构和组成能提供适用于广泛应用的性能特征；然而，由于不利的性价比，商业化的丙烯酸-硅烷和环氧-硅烷的市场占有率有限。本论文将介绍一种结合叔碳酸乙烯酯和乙烯基烷氧基硅烷单体的新聚合物系列，通过优化工艺参数，单体组成和烷氧基硅烷水平，获得了固体含量在 70% 至 100% 之间的一系列聚合物，展现出广泛优异性能及环保安全使用特性。本体系成本合理并且是高度多样化湿气固化技术。通过对配置涂料性能评估表明，除了不含异氰酸酯外，它还具有高固含量，快速硬度发展和非常长的保质期。这使这些乙烯基硅烷共聚物在一些面漆应用中成为双组分聚氨酯和丙烯酸-烷氧基硅烷的极具吸引力替代品，尤其是在防护涂料中。

Moisture-curing alkoxysilane resins have been increasingly used as isocyanate-free alternatives in marine and protective coatings applications. Similar to 2K polyurethanes, these systems display a broad range of performance characteristics, depending on their structure and composition. However, the commercially available alternatives, acrylic- and epoxy-alkoxysilane, have seen limited market penetration, due to an unfavourable cost/performance ratio. This paper presents a new family of polymers, which combine vinyl (neo)ester and vinyl alkoxysilane monomers. Variation of process parameters, monomer composition and alkoxysilane levels yielded a series of polymers with solid content between 70 and 100%, and exhibiting a wide scale of attractive properties and improved environmental profile. Performance evaluation of moisture cure coatings based on this cost-efficient and highly versatile technology demonstrates that it brings high solid content, fast hardness development and very long shelf life, in addition to being isocyanate-free. It makes these vinyl silane copolymers an attractive alternative to 2K polyurethanes and acrylic-alkoxysilanes for several topcoat applications, especially protective coatings.



王武生教授
Prof. Wang Wusheng

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如何做到的 —— 水性双组份聚氨酯涂料理论与实践

How It Works: Waterborne 2K PU Coatings Theory & Practice

论文 PAPER 4

水性双组份聚氨酯涂料是基于羟基功能化高分子分散体与水可分散多异氰酸酯组成的反应型双组份涂料。尽管近 20 年来水性双组份涂料在实践中已取得巨大成功，但其理论研究一直落后与实践。一个对水极为敏感的交联固化体系为何能在水体系统中实现？本论文将总结相关学术研究，从理论层面对水性双组份聚氨酯涂料得以实现做系统总结。

Waterborne two-component polyurethane coating (WB-2KPU) is a thermosetting reactive system comprised of water-dispersible polyisocyanates crosslinkers and mixed with hydroxy-functional polymers in a water disperse medium that crosslink upon application to a substrate. Despite the fact that practical knowledge regarding formulation and application of WB 2K-PU's has been recognized for the last two decades, minimal scientific information exists that pertain to its fundamental processes. How does a water-sensitive cross-linking reaction work in a water system? This presentation will summarize relevant academic researches and theories of waterborne two-component polyurethane coatings.



张明先生
Mr. Scott Zhang

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氟化聚合物（聚偏二氟乙烯）水性涂料

Fluoropolymer (PVDF)-Based Waterborne Coatings

论文 PAPER 5

白色冷屋顶涂料可反射太阳能，从而可减少使用建筑物内的空调，由此可降低发电用的化石燃料和碳排放。PVDF 树脂基涂层具有优异的耐候性、耐沾污性和耐化学性，特别适合白色冷屋顶涂料的应用。本论文将介绍水性 PVDF 乳液在白色冷屋顶涂料领域的应用，该水性乳液既可单独使用，亦可与水性丙烯酸树脂混合使用。PVDF 水性乳液制备的涂料可满足当前 VOC 排放相关环保法规，并同时具有长期耐候性和耐沾污性能，让建筑外层历久常新，保持白色冷屋顶热反射功效，特别适合中国市场应用。

White cool roof coatings can help reduce the use of air conditioning in a building, in turn decreasing carbon footprints. Polyvinylidene fluoride (PVDF)-based coatings are especially suited for cool white roof applications due to their excellent weatherability, dirt pickup resistance and chemical resistance. This presentation will introduce cool white roof options for waterborne PVDF emulsion, either alone or blend with waterborne acrylic resins. PVDF-based coatings are especially suited for China market, as they can readily meet current VOC environmental regulations, and also feature long-term weathering and anti-dirt pick performance, which can keep buildings look new and white, therefore keep them cool.



Ms. Kellie Salemo 女士

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独特的无钴催化剂 —— 用于改善氧化固化体系干燥时间及其他附加效益

Unique Cobalt-Free Catalyst for Improved Dry Times and Other Added Benefits in Oxidative Cured Systems

论文 PAPER 6

几十年来，传统氧化固化体系依赖常规干燥剂，例如钴和锰。尽管这些表面干燥剂具有效用，但却存在许多缺点。这些系统可能会遇到泛黄、变色、边缘干燥时间长，高膜厚度下的皱褶，及诸如未能符合无 APEO 和区域法规等要求的问题。本论文将讨论一种新型干燥技术，在这里，我们描述了铜-玻璃陶瓷粉末作为抗菌表面的添加剂；它的机制是基于控制从双相玻璃陶瓷的水不稳定相中原位形成的赤铜矿纳米晶体中释放铜 (I) 离子 (Cu^{1+})。依据美国 EPA 测试铜合金表面消毒功效的方法进行评估，含有铜-玻璃陶瓷粉末的胶乳涂料使金黄色葡萄球菌，铜绿假单胞菌，产气假单胞菌和大肠杆菌菌落计数减少 $\geq 99.9\%$ ，接近基准金属铜。

Traditional oxidative cured systems have relied on conventional driers such as Cobalt and Manganese for decades. Although these surface driers are efficient, there are many drawbacks that arise. These systems may encounter yellowing, discoloration, marginal dry time improvement, wrinkling at high film thicknesses, and issues with regulatory demands such as APEO-free and regional compliance. This presentation will discuss a novel drier technology that not only improves dry time, yellowing, and discoloration but may also yield surface-dry and through-dry in one drier.



Dr. Joydeep Lahiri
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Division Vice President and
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Corning Incorporated, USA

具有高抗菌功效的含铜玻璃陶瓷

Copper-Containing Glass Ceramic with High Antimicrobial Efficacy

论文 PAPER 7

医院获得性感染 (HAIs) 和产生抗生素耐药菌株是对人类健康的主要威胁。铜因其高抗菌效力而闻名，包括杀死超级细菌和臭名昭著的 ESKAPE 组病原体的能力。我们寻求一种材料能够保持铜的抗菌功效同时最大限度地减少含铜物质应用时的缺点——成本，外观和金属属性。在这里，我们描述了铜-玻璃陶瓷粉末作为抗菌表面的添加剂；它的机制是基于控制从双相玻璃陶瓷的水不稳定相中原位形成的赤铜矿纳米晶体中释放铜 (I) 离子 (Cu^{1+})。依据美国 EPA 测试铜合金表面消毒功效的方法进行评估，含有铜-玻璃陶瓷粉末的胶乳涂料使金黄色葡萄球菌，铜绿假单胞菌，产气假单胞菌和大肠杆菌菌落计数减少 $\geq 99.9\%$ ，接近基准金属铜。

Hospital acquired infections (HAIs) and the emergence of antibiotic resistant strains are major threats to human health. Copper is well known for its high antimicrobial efficacy, including the ability to kill superbugs and the notorious ESKAPE group of pathogens. We sought a material that maintains the antimicrobial efficacy of copper while minimizing the downsides – cost, appearance and metallic properties – that limit application. Here we describe a copper-glass ceramic powder as an additive for antimicrobial surfaces; its mechanism is based on the controlled release of copper (I) ions (Cu^{1+}) from cuprite nanocrystals that form in situ in the water labile phase of the biphasic glass ceramic. Latex paints containing copper-glass ceramic powder exhibit $\geq 99.9\%$ reduction in *S. aureus*, *P. aeruginosa*, *K. aerogenes* and *E. Coli* colony counts when evaluated by the US EPA test method for efficacy of copper-alloy surfaces as sanitizer, approaching that of benchmark metallic copper.

第三节 SESSION III

19.11.2019 (星期二 Tuesday) • 13:00 – 15:15



刘彤舟博士 Dr. TZ Liu

总经理
施美克化工有限公司, 中国
General Manager
Semeka Chemical Co., Ltd., China

欧盟汽车修补漆面漆 420g/L VOC 标准分析

Analysis of EU's 420 g/L VOC Limit for Car Refinish Topcoats

论文 PAPER 8

在制定汽车漆, 尤其是汽车修补漆的 VOC 排放标准过程中, 欧盟关于汽车修补漆的 VOC 排放标准 (Directive 2004/42/CE) 得到很高的关注、参考和引用。然而, 在市场上和汽车漆行业内部, 对这个标准却缺乏正确理解。本论文将分析和讨论 2004/42/CE 中的关于汽车修补漆面漆 420g/L VOC 限值的含义和要点, 包括: 水性漆 VOC 计算、市场上所谓符合欧盟标准的水性汽车修补漆、用油性高固低粘技术可做出 420g/L 的实色面漆和清漆、制定低 VOC 排放标准的要点等。

While producing VOC limits for automotive paint, especially automotive refinish, the EU's VOC limits for car refinish coatings (Directive 2004/42/CE) is highly recommended and also used as a reference. However, there is lack of understanding about this Directive. This presentation will analyze and discuss key points of 420 g/L VOC limit for car refinish topcoats under the Directive 2004/42/CE, as well as cover the following - calculation of VOC in waterborne paint, the so-called Directive 2004/42/CE compliant refinish found in the market, production of 2K topcoat and 2K clearcoat with VOC < 420g/L and keys to establish a low VOC emission standard.



申亮教授 Prof. Shen Liang

江西科技师范大学化学化工学院, 中国
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蓖麻油基涂料用树脂的制备和性能研究

Synthesis & Properties of Castor Oil-Based Resin for Coatings

论文 PAPER 9

蓖麻油及其脂肪酸因同时具有羟基和碳碳双键两种反应性官能团, 常用作制备聚合物如蓖麻油基聚氨酯、蓖麻油基丙烯酸及环氧树脂等起始原料。本论文内容主要为新型改性蓖麻油基单体或预聚物的制备, 及其在水性聚氨酯分散体和 Michael 加成固化涂料用树脂中的应用研究。

Because castor oil (or its fatty acids) carries two reactive functional groups of hydroxyl and carbon-carbon double bonds, it is often used as a starting material for preparing polymers such as polyurethanes, alkylated resins, epoxy resins, etc. This presentation will focus on preparation of novel modified castor oil base monomers or prepolymers, as well as application of waterborne polyurethane dispersants and Michael addition reaction curing coatings.



Dr. Michael P. Diebold 博士

科学院士, 科慕, 美国
Technical Fellow Technology,
Chemours Company, USA

钛白粉颜料对涂料光泽保持的多重效应

Multiple Effects of TiO₂ Pigment on Paint Gloss Retention

论文 PAPER 10

大多数涂料中有机基材料会随着时间的推移而分解 - 尤其是暴露在室外的, 这种分解导致涂料外观发生许多变化, 尤其是光泽。光泽度下降是一种复杂现象, 光泽保持率受许多因素决定, 包括许多钛白粉的颜料特性, 其中一些是众所周知的, 而其他则鲜为人知或被误解。这些经常相互矛盾的效应可使用曝光漆膜发生中的物理和化学变化的综合模型来解释。本文中, 我们详述以上所述的综合模型并讨论相关实验室资料。

It is well known that the organic binder in most paints will decompose over time - particularly when exposed outdoors. This decomposition causes a change in many important paint appearance attributes, especially gloss. Gloss loss is a complex phenomenon, and gloss retention is determined by many factors. These include a number of TiO₂ pigment properties, some of which are well recognized, others of which are poorly known or misunderstood. These often conflicting effects can be explained using a comprehensive model of physical and chemical changes that occur in a paint film on exposure. This presentation will describe this model and discuss supporting lab data.

第四节 SESSION IV

19.11.2019 (星期二 Tuesday) • 15:30 – 17:15

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纳米透明功能涂料的发展

Development of Nanometer Transparent Functional Coatings

论文 PAPER 11

利用纳米粉体和纳米技术可制备纳米功能涂料, 其中最有应用价值的是纳米透明功能涂料及相关产品, 包括: 纳米透明隔热涂料、透明隔热贴膜、涂膜隔热玻璃、透明隔热塑胶板。本论文将讲述这些产品所采用的纳米粉体原料、制造方法及工艺, 各产品达到的性能指标及应用范围。这些产品虽已有十余年发展历史, 但近年在中国迅速发展。这些纳米透明节能材料在中国有 1000 亿以上的市场需求, 值得我们认真研究、开发与应用。

Nano-functional coatings can be prepared by using nano-powder and nanotechnology. Their most valuable applications are nano-transparent functional coatings and related products, such as nano-transparent thermal insulation coatings, transparent thermal insulation coatings, coated thermal insulation glass, transparent thermal insulation plastic plate. This presentation will talk about nano-powder materials, manufacturing methods and processes used in these products, as well as performance indicators and application ranges achieved by each product. Though these products have seen over 10 years of development, they have been developing rapidly in recent years. The market of nano-transparent energy-saving materials values over RMB¥100 billion in China, therefore worth of delving further research, development and application.

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用于高性能聚氨酯涂料的新型异氰酸酯

New Isocyanate for High-Performance Polyurethane Coatings

论文 PAPER 12

今天, 涂料、粘合剂和材料行业正面临环境变化的挑战。涂料是特别需要高性能的一个领域, 因为涂层的功能在美学之外主要是为了保护其所施工的基材。聚氨酯涂料, 特别是双组分体系, 因其出色的性能, 尤其是耐久性和户外耐候性而受到青睐; 聚异氰酸酯作为聚氨酯和聚脲技术的基础材料, 显然在这趋势中发挥着重要作用。本论文将介绍两个研究专案: 一是水基系统, 另一是溶剂型低 VOC 系统的解决方案, 尤指聚氨酯产品。

Today's challenges for coatings, adhesives and materials industries are clearly environment oriented. Coatings particularly is one field in which high performance is required since the function of a coating, outside of its aesthetics, is mainly to protect the substrate it is applied on. Polyurethane coatings, especially two components systems, are very appreciated for their outstanding performances, especially durability and outdoor weatherability. Polyisocyanates as building blocks for polyurethane and polyurea technology have clearly their role to play in this trend. Two routes will be exposed in this presentation: One dealing with water based system, the other proposing original solutions for solventborne low VOC system, more specifically for polyurea products.

Mr. Jerome Douce

研发总监
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R&D Director
Vencorex, France

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