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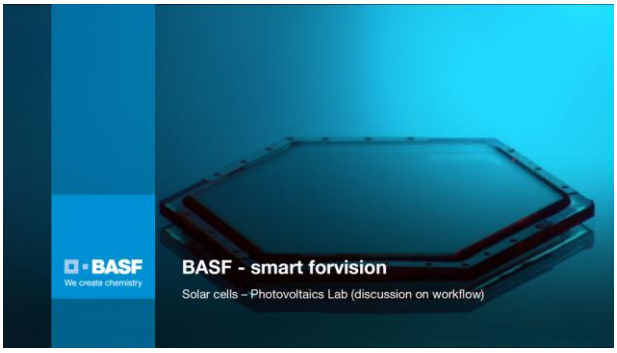
Concept car "smart forvision"

Daimler AG and BASF SE have developed a new concept vehicle that combines both companies' ideas for holistic electric mobility. The two companies have combined their technological competencies for the first time, developing a futuristic vehicle concept.

With the smart forvision Daimler AG and BASE SE are not only showing that electric mobility can make emission-free driving possible. At the same time it paves the way for new technologies in the automotive sector..

(01) Organic color solar cells

09/10/2011; 14:30; A1/A2: Atmo; FullHD



00:00

Photovoltaic Laboratory – Discussion of work flow

In the Photovoltaic Laboratory, Dr. Ingmar Bruder, head of the organic photovoltaic research lab, and Nicole Kaiser, chemical laboratory assistant, discuss the work flow for the preparation of organic color solar cells. These special solar cells are based on organic dyes that BASF SE has developed, and are used in the roof construction of the **smart forvision** concept automobile. There they generate energy from the radiating sunlight and this energy can be used to operate electronic equipment, as for example the multimedia system.

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02:24

Photovoltaic Laboratory – spray pyrolysis of the solar cell substrates

An electron blocker layer is applied by means of spray pyrolysis. This is a thick layer of titanium dioxide. This layer prevents short circuits from occurring on the substrates.

03:49

Photovoltaic Laboratory – hole transport coating

The substrates are given a hole transport layer, which provides the flow of electricity in the cell. This layer is applied by spin coating. The reaction time and rotation speed determine the thickness of the layer.

06:32

Photovol Photovoltaic Laboratory – measuring the efficiency of solar cells

Dr. Ingmar Bruder checks the efficiency of the organic color solar cells. For this purpose, six solar cells are clamped in a metal jacket and placed in a measuring robot. Various light conditions are simulated by means of a xenon lamp und different filters. The generation of electricity or the efficiency of the organic color solar cells is determined.

08:11

Photovoltaic Laboratory – determining the lifespan of the solar cells

The apparatus for determining the lifespan simulates in time-lapse the various demands and stresses to which organic color solar cells are exposed in daily use. For this purpose, the solar cells are clamped in a metal jacket, placed in a circle around a halogen lamp in the measuring apparatus and connected to a computer. The latter measures the performance of the solar cells during the test.

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10:12

Photovoltaic Laboratory – coloring the layer of titanium dioxide

The layer of titanium dioxide of the organic color solar cells makes it possible to color the solar cells. Titanium dioxide is widely used in industry, for example in the production of coatings, paper or as a UV blocker in sun screens. The solar cell is dipped in a bath of lightsensitive dye. The layer of titanium dioxide absorbs the dye. Almost any color is possible.

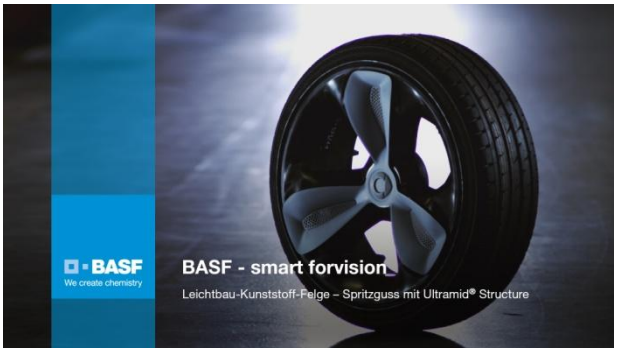
13:26

Pack-Shots – solar cells

BASF SE has developed solar cells based on organic chemical dyes, with which it has been possible for the first time to construct the whole roof of a vehicle with transparent color solar cells all over. By means of this technology, the solar roof of the **smart forvision** can generate electricity very efficiently even when the light conditions are poor, and this relieves the strain on the battery. Furthermore, it is a unique design element. Thus the transparency of the solar cells makes the combination with organic LED illumination possible, with the “glass roof effect” at the same time.

(02) Thermoplastic polymer wheel rim

09/10/2011; 09:50; A1/A2: Atmo; FullHD



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00:00

Injection molding with Ultramid® Structure – Production and tolerance test

The two parts of the thermoplastic polymer wheel rim, namely the supporting cover and the structural part, are produced in the injection molding process from the high-performance plastic Ultramid® Structure from BASF SE. Hummel-Formen GmbH in Lenningen is responsible for the manufacture.

03:30

After the manufacture, Dr. Heiko Heß, application developer at BASF SE, and Thomas Wolf, technical sales at Hummel-Formen GmbH, carry out the tolerance test of the polymer wheel rim by means of a dial gauge. The rim must satisfy certain prescribed tolerance values.

04:18

Assessing tested plastic rims

The head of wheel and tire development Dr. Günter Leister of Daimler AG and the development engineer Judith Reiser of Daimler AG assess together with BASF application developer Dr. Heiko Heß the lightweight rim of Ultramid® Structure. It is the first polymer wheel rim suitable for mass production.

06:05

Lifespan test on two-axial wheel test bench

The thermoplastic polymer wheel rim is subjected to a lifespan test on a two-axial wheel test bench. This test simulates in time-lapse the daily driving operation and the stresses that occur and have an effect on the wheel. Strain gauge strips are installed in the thermoplastic polymer rim and are used to record and register deformations of the rim.

07:10

Tolerance test on wheel measuring machine

The geometry of the polymer wheel rim is measured and evaluated in the wheel measuring machine after production. The innovative material Ultramid® Structure is suitable not only in vehicle construction but also

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everywhere where heavy-duty but, at the same time, lightweight components are needed and metal is to be replaced: for example in mechanical engineering as well as in leisure and sport sectors.

08:25

Rotary test under bending conditions

A further component test that the polymer wheel rim of Ultramid® Structure has to pass is the rotary test under bending conditions. In this test, the polymer wheel rim is stressed with a bending moment. The recurrently occurring stress on a rim in everyday use is simulated.

09:11

Drop tower impact test

In the impact test, the polymer wheel rim has to withstand very high stresses. By using Ultramid® Structure, it has been possible for the first time to manufacture such a safety-relevant component of plastic. The rim of Ultramid Structure is just as strong and resistant as a steel or aluminum rim, but provides a potential weight reduction of up to 30 percent.

09:29

Pack-Shots – Thermoplastic polymer wheel rim

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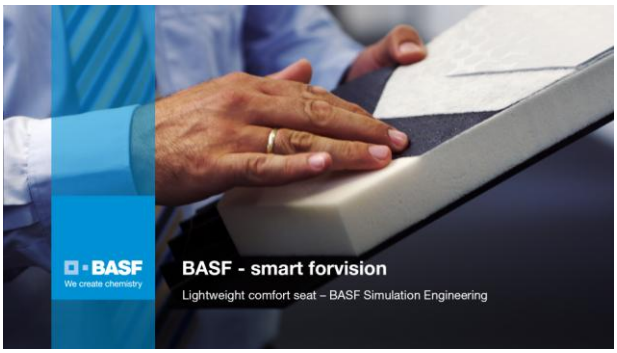
(03) Lightweight comfort seat

09/10/2011; 03:05; A1/A2: Atmo; FullHD



00:00

BASF Simulation Engineering – Structural optimization and CAE Analysis

Rie Kaneko, Torsten Hensel and Andreas Wüst from the division of Simulation Engineering (ULTRASIM™), discuss the optimum mechani-cal structure of the seat shell of the lightweight comfort seat on the ba-sis of the simulation results. In the design of the one-piece, self-supporting plastic seat shell, use was also made of what is now BASF's universal simulation instrument ULTRASIM™, after topology optimization. The BASF developers used this to virtually predict the structural behavior of the seat shell in the **smart forvision** under various stress conditions.

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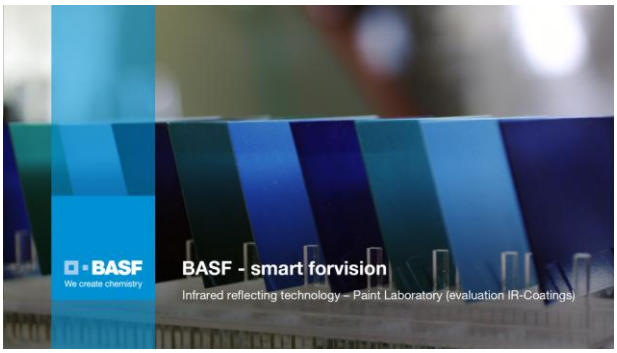
(04) Infrared reflecting technology

09/10/2011; 06:58; A1/A2: Atmo; FullHD



00:00

Paint Laboratory – Evaluation IR-Coatings

Ursula Schulze Tilling, Technical Service, Dr. Rainer Henning, marketing for Automotive Coatings, and Christian Schuch, an employee in the laboratory, discuss the quality of the coating samples using sample platelets of metal that have been coated with IR-reflecting coatings from BASF SE. These coating samples have been prepared by means of an automated mixing apparatus. After the application of the starting materials and pigments, the robot arm takes over all the further steps in the mixing apparatus and prepares the coating. Special color pigments from BASF SE in the coating, known as “Cool Pigments”, enable the thermal radiation of the sun on for example a vehicle to be largely reflected even from dark surfaces.

01:45

High-Throughput Lab for Coatings – Optimization of the IR coating formulations

In a high-throughput apparatus for coatings, the coating is automatically formulated, sprayed onto sample platelets and hardened. The sample platelets that are produced are then subjected to various use, stress and quality tests. Light coatings, like this one of the **smart forvision**, reflect not only visible light but also infrared radiation. Dark surfaces normally absorb the latter and thus heat the automobile up. Special color pigments (“Cool Pigments”) from BASF SE enable the thermal radiation to be largely reflected even from dark surfaces.

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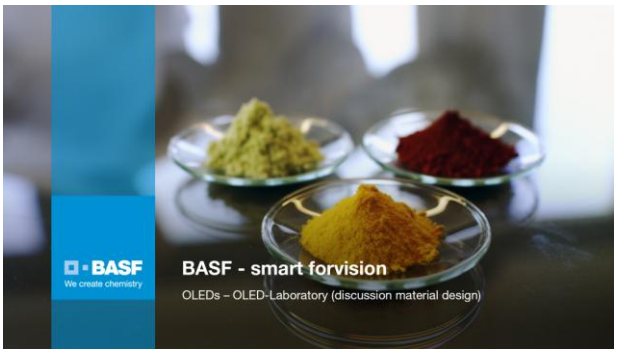
04:22

Lab Thin Film Rechnology – Inspection IR-films

Technologies that effectively reflect infrared radiation are also used in the windscreen and side windows of the **smart forvision**. A special transparent organic polymer film from BASF SE that is integrated into the windows enables the interior of the vehicle to remain cool longer. Like the “Cool Pigments” in the coating, this polymer film reflects infrared radiation, thus reducing the energy consumption of the air conditioning and enhancing the traveling comfort. Project leader Miwa Sashida and the physicist Dr. Jochen Brill assess here the optical quality of the windscreen with the integrated polymer film of the **smart forvision**.

(05) OLEDs

09/10/2011; 11:55; A1/A2: Atmo; FullHD



00:00

OLED-Laboratory – Discussion of material design

Laboratory assistant Kristin Schwickert, laboratory head Dr. Stefan Metz, laboratory assistant Georg Beck and quantum chemist Dr. Christian Lennartz discuss a new synthesis idea before the preparation of the semiconductor material that will be used as the starting material in the production of organic light-emitting diodes, known as OLEDs. Apart from not only providing new design possibilities due to the free choice of colors, OLEDs are also significantly more pleasant for the driver, since unlike conventional illumination, they do not create a

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glare. BASF SE is developing highly efficient semiconductor materials for the OLED technology, particularly for generating light.

03:04

OLED-Laboratory – Mixing the semiconductor material

In a reaction flask, the laboratory assistants Kristin Schwickert and Georg Beck mix the organic semiconductor material from various substances, the material being used as the starting material in the production of organic light-emitting diodes (OLEDs). The substances are mixed together with a magnetic stirrer.

05:24

OLED-Laboratory – Separation/cleaning of the semiconductor material in a column chromatograph

The organic semiconductor material that has previously been mixed is cleaned and separated in a chromatograph. Laboratory assistant Georg Beck controls the cleaning process by means of a computer. After the cleaning, the carrier solvent containing the cleaned substance is then collected in test tubes.

07:51

OLED-Laboratory– Separation/cleaning of the semiconductor material (time-lapse)

The separation of the organic semiconductor material in time-lapse. The semiconductor material is separated into its components in a silica gel column. In this way, the substances (for example green, orange, blue and yellow) can be isolated from the original mixture as pure substances.

08:12

Clean room laboratory – Preparation of substrate

In the cleanroom laboratory of an industrial partner, with whom BASF SE jointly produces organic light-emitting diodes, a glass substrate is vapor coated with the organic light-emitting diodes (OLEDs). In the finished state, partially transparent OLEDs look like transparent glass sheets and change, at the press of a button, into bright areas. The aim of the development of OLEDs is to make them 50 percent more efficient than standard energy-saving lamps.

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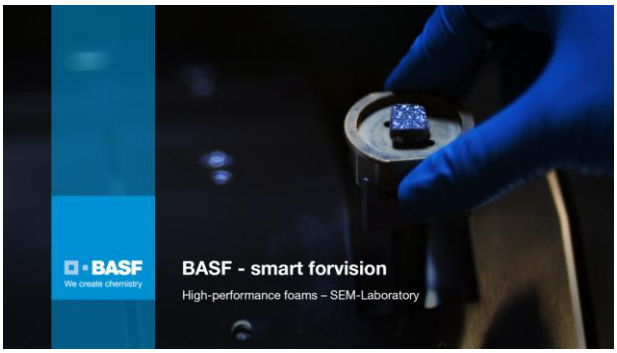
10:38

Clean room laboratory – OLED vapor deposition process

An employee of the industrial partner checks the vapor coating process, while a colleague carries out the quality control. In the **smart forvision**, the organic light-emitting diodes are used together with transparent organic color solar cells in the roof construction. The result is what is known as the “glass roof effect”, and the free choice of color of the OLEDs opens up new design possibilities. BASF SE is developing highly efficient semiconductor materials for the OLED technology, particularly for the generation of light.

(06) High-performance foams

09/10/2011; 05:22; A1/A2: Atmo; FullHD



00:00

SEM-Laboratory – Investigation of foam structure

The chemists Dr. Elena Khazova and Dr. Marc Fricke assess photographs of the high-performance foams that have been obtained with a scanning electron microscope. The nano-porous structure of the high-performance foam becomes visible under the scanning electron microscope. On the screen, the broken edge of the sample can be seen in a magnification of 65000 : 1. The vacuum isolation panel (VIP) that is shown contains the high-performance foam. The latter can consist of various polymer materials. In the form of such panels, high-performance foams are used where the best insulating performance is required in a very confined space.

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02:48

Laboratory – Experimental proof of superior thermal insulation performance

Dr. Elena Khazova carries out thermographic measurements (heat measurements) of a vacuum insulation panel (VIP), which contains the high-performance foam. For comparison, a panel with conventional polystyrene insulating material is used. In order to carry out the test, the two foams are placed on a hot plate that is then heated to 60°C (left: conventional foam, right: high-performance foam). By using an infrared camera, temperature differences on the surface become visible. The vacuum panel with the high-performance foam remains at approximately room temperature, whereas the temperature of the conventional insulating material rises by 11°C.

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