

The Survivability Experts

IBD LIVE

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High Performance NANOTech Liners

Improved performance of IBD C1 liners over extended temperature range.

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Certified Low Weight Solutions with NANOTech



IBD NANOTech solutions continue to be certified for new applications

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Transparent NANOTech Ceramics

IBD's development of technologies for the production of large windows with transparent ceramics will allow for drastic weight savings.

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Evolution Survivability Concept based on IBD NANOTech

The synergistic effects of the IBD NANOTech materials within the Evolution Survivability Concept.

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Active Signature Management

Steerable colours to adapt the vehicle signature to the background.

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New IBD Facilities

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IBD SPECTRUM

Increased Protection Level for Light Vehicles

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AMAP™

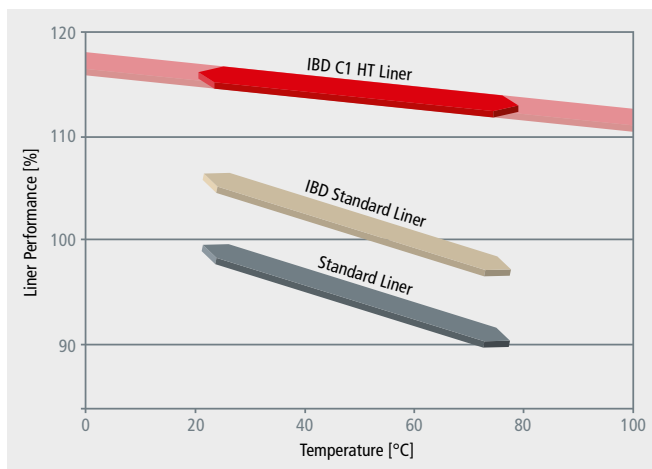
The new Generation of Survivability Systems



High Performance NANOTech Liners

Liner systems, an integral part of IBD's protection concepts, have been amended by hybrid-liners with a density significantly less than 1g per cm^3 as well as high temperature liners. The improved performance of these liners is also based on nano-technologies.

Especially the high temperature liner family AMAP-L C1 shows a significantly higher ballistic strength than comparable liners. Furthermore due to its extremely wide operating temperature range of up to $+120^\circ\text{C}$ it has an almost constant ballistic performance up to $+80^\circ\text{C}$.



This has become an important feature in hot areas where the vehicle hull can easily be heated up to 60°C and more. Standard liners become significantly weaker at these temperatures. Therefore the new high temperature liners are an important improvement to maintain the protection even under extreme conditions.

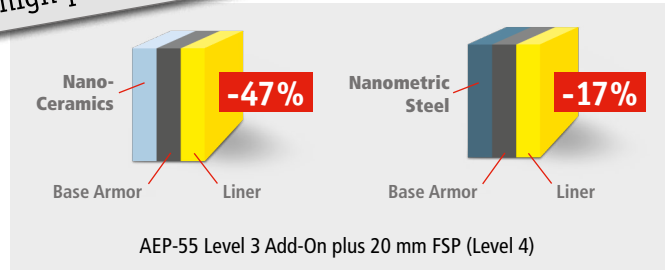
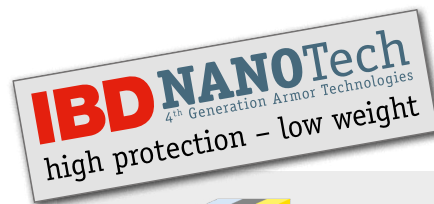
The new liners are insensitive to humidity. This is of particular interest in tropical areas.

Certified Low Weight Solutions with IBD NANOTech

The outstanding performance of the IBD NanoTech Products results in drastic weight savings of the protection kits. Depending on the size of the vehicle these savings can range from 350 kg for light 4x4 vehicles at STANAG 4569 Level 3 protection up to 1000 kg for medium size 8x8 vehicles at STANAG 4569 Level 4 protection.

E.g. a protection kit according to STANAG 4569 Level 3 can be built with an areal density of 32 kg/m^2 only. The same kit is also safe against fragments according to STANAG 4569 Level 4.

Several certifications for different platforms and applications have been awarded so far, among them a certificate from the German Test and Certification Authority.



One example for the combined and qualified application of the nano-technologies is the MPV 4x4 vehicle from Iveco. This combination is the result of an optimisation to balance the requirements regarding protection level, weight and costs.



Transparent NANOTech Ceramics

With the large windows of armored vehicles transparent protection has become a large portion of the overall armor weight. Furthermore the heavy transparent armor is always located in the upper parts of the vehicle which has a negative effect on the dynamic performance of the vehicle. Therefore great efforts are made to search for lighter materials. IBD made a big step towards light transparent armor.

The basis for the new product is nano-crystalline transparent ceramic material, a derivative of the latest IBD ceramic technology. It was a design goal to reduce the crystal size as much as possible in order to improve the transmittance of the material.

The development of large windows made from transparent ceramics is a result of the combined efforts to produce thick transparent tiles, thick transparent organic carriers and to develop a joining technology allowing the assembly of tiles such that no glue lines can be seen. Transmittance of the composite material will conform to the actual requirements and allow the use of night vision goggles.

The new transparent armor will cut the weight of today's window screens approximately in half. For vehicles with typical window surfaces of total 3 m^2 the weight saving will be between 100 and 200 kg. The temperature range of the transparent ceramics will exceed $+50^\circ\text{C}$.

Evolution Survivability Concept based on IBD NANOTech

The Evolution Survivability Concept was designed as a generic protection concept for almost all kinds of platforms. It makes use of the synergistic effects of the different IBD protection technologies to achieve a maximum protection level at minimized weight.

The combination of the IBD NANOTech materials described in the previous articles support this effect in a progressive way such that the survivability kits can be designed with even higher protection levels at unmatched low weight. Examples for the application of the advanced Evolution Survivability Concept are described on page 4.



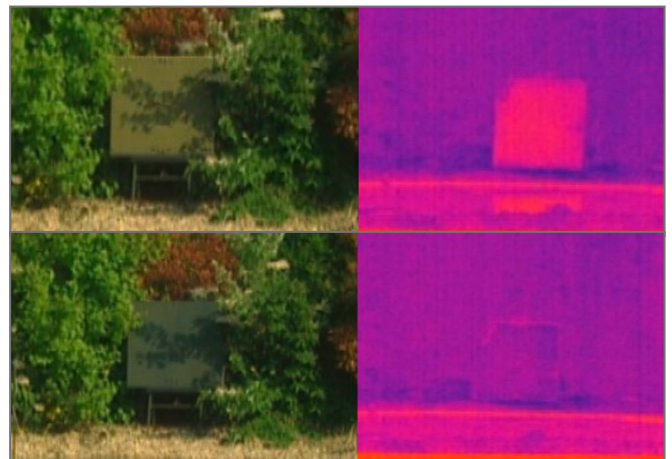
Active Signature Management

Due to the availability of low cost night detection systems signature management in the near IR spectrum has become an important issue in the design of Survivability Systems.

The IBD development of steerable colours makes use of the electrochromic effect of certain organic substances. When applying a voltage the colour of the substance changes. While the vehicle is moving a sensor monitors the colour of the background. This is fed back into a control circuit that adapts the colour of the vehicle paint to that of the background.

The effect of steerable colours is not limited to the visible range of the spectrum. It extends into the IR range thus providing a means to reduce detectability of the vehicle by night goggles.

The technology can be integrated into the ballistic protection kits.



New IBD Facilities

In order to meet the increased demands of our customers as well as to support the further developments of technologies and the necessary production processes IBD. The new building will contain facilities for research, development and processing of new materials, production space for protection kits and the integration in platforms.

The new building will be ready by October 2011.



IBD SPECTRUM

Increased Protection Levels for Light Vehicles

The advantages of the NANOTech technologies are of special interest for light vehicles because of their limited



load capacity. Among them are the Astra Truck from Iveco and the MSV, an APC 4x4 vehicle from Textron. Both platforms are now equipped with Survivability kits based on the Evolution Concept providing protection levels that were not achievable with the standard technologies.

Improvements on 6x6 and 8x8 APC Platforms

An example of the successful integration of the new technologies is the AMV 8x8 from Patria with an overall weight reduction of the protection kit of 40%. Due to the weight savings on the ballistic protection major improvements on the mine protection could be made.



Available Solutions for Armored Combat Vehicles



Similarly a comprehensive Evolution Survivability Concept was designed for different combat vehicles and MBTs. Examples of these applications are the CV90 and the Leopard 2. This comprehensive concept can be used for any version of these platforms.

Aircraft Applications

With the NANOTech materials the extreme weight constraints in aircraft applications could be met. As a result the Tiger helicopter is equipped with



protection kits using the NANOTech Ceramics. The production line has been qualified according to aerospace standards.

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