

Project name: TRAM: DEVELOPMENT OF NEW TRANSPARENT MATERIALS FOR ARMOUR APPLICATIONS

End date: 2008

Participating countries: Czech Republic, Italy, The Netherlands and Germany

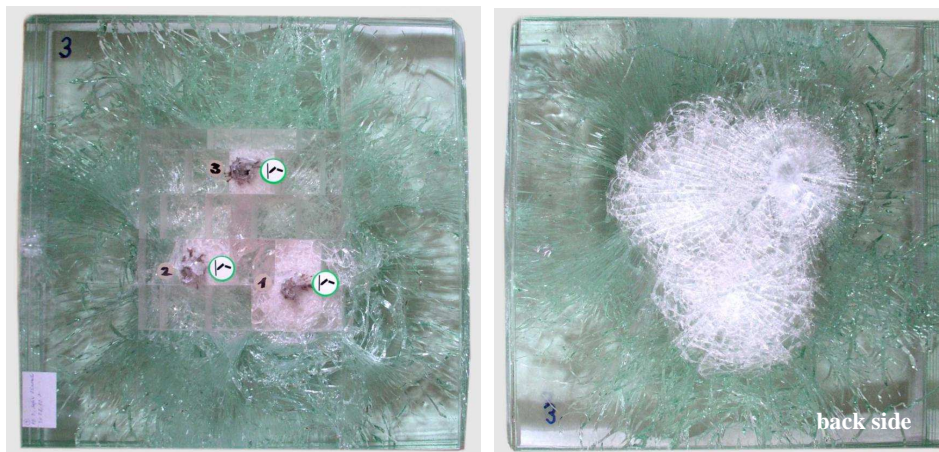
Who was there: The TRAM project was carried out by a consortium of leading European industrial partners from VOP-026 Sternberk s.p./VTUO Brno division, SVOS, spol. s r.o., Saint-Gobain Advanced Ceramix, s.r.o., Oto Melara S.p.A., Industrie Bitossi S.p.A., TNO DS&S, Rijswijk, TNO S&I Eindhoven, Saint-Gobain Glass International R&D, SAS van Gent BV Glasfabriek and HB Consultancy.

Summary

The main goal of the TRAM project was to develop and demonstrate lightweight solutions for transparent armour with good transparency properties in the relevant wavelength spectrum.

The objectives of the project were as follows: the TRAM project studied the performance of modern transparent armour materials with respect to ballistic and transparency properties.

The application areas were facial screens, windows of personnel carriers and light armoured vehicles, other mobile or non-mobile systems and helicopters against small calibre ammunition and fragments. Application of transparent armoured materials in sight systems and optical instruments were also studied. Basic transparent materials and layered armoured structures were characterised and tested using small-scale armour. The study was supported by modelling for a better understanding of material behaviour and damage mechanisms in transparent materials and layered structures. Simulation was used for armour design.



Developed transparent armour after ballistic testing – front and back side.

In detail

The main goal was to develop and demonstrate lightweight solutions for transparent armour with good transparency properties in the relevant wavelength spectrum (visible, infrared and ultraviolet). The final output of the Tram project should consist of:

1. Reports of the mechanical and physical properties of modern transparent materials in armour applications.
2. Practical solutions and design guidelines for transparent armour.

3. Demonstration on mock up equipped with transparent armour.

PROJECT RESULTS

The project dealt with the development of new transparent materials with high hardness, which could be used in armours resistant to projectiles. Within the frame of the project the transparent materials suitable for using as hard frontal layer of armour were found. The hard material was combined with several glass layers of different thicknesses to form laminated transparent armour.

The TRAM project aim was fulfilled. Developed transparent armours have good transparency and smaller thickness and areal density (saving up to 58%) than glass armours available on the market at project beginning.