

CAE validation study of a side window impact using PLEXIGLAS® materials

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An experimental and numerical study regarding the head impact on a side rear window was performed. Based on several years of material development and manufacturability (Evonik Industries AG), the expert knowhow in material testing and LS-DYNA material implementation (Giessen Institute of Mechanics and Materials) and the CAE user experience (TECOSIM Technische Simulation GmbH) and in closer cooperation between all parties, it was decided to start a development study. The outcome of the study should show the behavior of different PLEXIGLAS® (PMMA) windows using different PLEXIGLAS® grades and possible feasible combinations.

The study was based on a custom made predefined head impact to a fixed side window of a reduced TEC|BENCHTM FE-Model*. Since the side window typically is defined as a small area a child head had been selected as impactor. The impact direction was predefined as perpendicular to the central impact point of the window geometry. The hardware testing was conducted by ACTS GmbH & Co KG at 10 m/s.

This paper shows the correlation between simulation and hardware tests and also the potential of the PLEXIGLAS® materials to ensure crash impact performance for the automotive, aviation and building industries. All simulations were performed using LS-DYNA V971 R7.0.0 as solver and HyperWorks as pre- and postprocessor.

This study could be used as a starting reference point to material substitution of glass for weight reduction, for easy forming of complex geometries and to increase safety protection.

*TEC|BENCHTM FE-Model is the property of TECOSIM Technische Simulation GmbH.

Keywords:

Material validation, concept development, crash analysis, automotive, aviation, building and home appliance industries.