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# ON THE DEVELOPMENT OF A NEW VEHICLE SAFETY SYSTEM FOR A STANDARD AND NON-STANDARD SEATING CONFIGURATIONS

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**Summary:** New trend in the automotive industry towards future vehicles brings new challenges in the passive and active safety features. The new seating configurations in the autonomous cars are hand to hand connected with new, and more complex crash scenarios, where the standard vehicle restrain and safety systems can lose their benefits or decreases level of their functionality. In the standard vehicles, the three main directions of the impact are to be considered, namely frontal, rear and side impact. However, changing of the seat positions and seating configurations will result in the multidirectional loading, and for such complex collisions, the safety systems must be adopted. This paper describes process of development of a new safety system, called nanobag: two thin layer curtain folded under the roof of the vehicle. Such technology consists of an elastic wall, brackets, gas generator and controlling system. They are all folded under the roof and deployed under sensor activation (similarly to the standard airbag). The main innovative of this system is in the material used for the curtain. It is a linear low density polyethylene (LLDPE), standardly used in the packaging and cargo of the goods. The main benefits of this system lay in the low material cost and weight, simply maintenance and non-sensitivity for out-of-position, which is one of the main weakness of the traditional airbags. The paper firstly describes experimental material testing of LLDPE, where simple pulling test with the small specimens (quasi-static and dynamic loading to include strain rate behavior) and drop test with the cylindrical impactor were performed. Authors used these data to build a LLDPE material model for the Virtual Performance Solution (VPS) software. LLDPE material reports orthotropic behavior in the two main perpendicular directions (machine direction and transversal direction) and such behavior needs to be considered in the testing as well as in the modelling. The validated material model of the LLDPE foil was included in the crash scenarios to test its behavior and benefits in the passenger safety. The study here considered frontal crash scenarios in 30 km/h and 50 km/h respectively and compared the safety assessment of the nanobag to the standard airbag for various anthropometries of the occupants. Next step of the development was to test the nanobag system in the non-standard seating configurations that are tightly connected with the future autonomous vehicles. Here, authors analyzed two new seat positions, where four passengers are facing to each other, as is assumed in the autonomous vehicles. The results show a good potential of this innovative safety system in the automotive safety. However, it is still under development, but such a solution can be considered for the further safety development to support current technologies toward safer vehicles.