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Experimental testing and modelling of expanded glass granules under high compression

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In modern shipbuilding double hulls are a common design to increase the stability and collision behaviour of ships. To improve the collision safety the filling of the void space between the hulls with energy absorbing and strength increasing material can be considered. This approach was suggested in [1] to improve the penetration resistance in case of the collision with a bulbous bow using granular materials.

This contribution deals with the experimental testing of lightweight granules like expanded cellular glass beads in a simplified collision test. To do so, two steel plates are used as outer and inner side hull structure. A rectangular steel box is welded in between these panels, which can be filled with granular material. As model for the bulbous bow a hemisphere is used and is driven into this structure. The glass beads considered have a diameter of about two millimeters and a multicellular structure as described in [2, 3].

The experiment will be used to validate the simulation of the penetration of the double hull with the bulbous bow. On the one hand the granules are modelled on the macroscopic level using the Mohr-Coulomb material model. On the other hand the material parameters of single particles are determined for discrete element simulation. To account for the parameter variation of the granules a statistical model is developed and presented.

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