High strain rate out-of-plane compression of birch plywood, effect of humidity content from ambient to cryogenic temperatures

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ABSTRACT

Plywood and birch plywood in particular have been used by the shipbuilding industry for four decades. Nowadays, liquefied Natural Gas shipping transport is receiving more and more attention. LNG carriers must provide cryogenic reliability and safety for at least 40 years. Most of the insulation systems belong to the so-called membrane type, in which the ‘insulation complex’ is composed of a metal membrane as a barrier (1.2 mm thick, 304 grade stainless steel), a plywood panel (12mm thick, cross-ply plywood made from 9 birch veneers birch wood), insulation foam (Reinforced PolyUrethane Foam), and a plywood panel glued to the inner hull.

In order to evaluate the risk of perforation of the membrane, and the role of the plywood in the perforation process, a series of impact tests are carried out and an extensive series of compression tests with birch plywood [1] specimens is conducted in the out-of-plane direction [2]. In this presentation, various experimental conditions are tested with different temperatures, strain rates and humidity contents. To this end, a specially designed Split Hopkinson pressure bar protocol is defined, and the specimen dimensions are validated from quasi-static EN789 standards experiments. Temperatures are ranging from ambient down to $-170^\circ$C, while strain rates are increased from 0.004/s up to 700/s and humidity contents ranging from 2 to 15% relative weight [3]. The analysis of the experimental results focuses on the hardening behaviour and the following densification regime at large strains.

REFERENCES