CHARACTERIZATION OF BAMBOO LAMINATES FOR NAUTICAL CONSTRUCTIONS

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Introduction

The use of sustainable materials is involving all application areas, including those requiring demanding structural performances. In nautical constructions, for instance, after plastics and composites have extensively replaced wood, a return to natural sources is anticipated, provided performance levels required by modern structures are satisfied. In this context, bamboo laminates present close resemblance to fiber composites and exploiting of their characteristics can provide mechanical and functional properties making them a viable alternative to present fiberglass materials. Bamboo in the form of thin sheets with unidirectional fibers can be laminated by techniques adapted from fiber composite technologies to produce boat panels and components. With consideration of the similarity with fiber composites, experimental and modelling techniques to determine actual attainable performances are investigated.

Material and methods

Laminates made of 4 plies (0/90)s or 8 plies (0/+45/-45/90)s were produced by gluing bamboo unidirectional sheets with epoxy resin in vacuum bag. Laminates were characterized by water absorption tests; static and dynamic-mechanical properties of the laminates were measured, also in consideration of water contact.

Results and discussion

Thanks to the relevant performances of bamboo in the fiber direction, to the possibility selecting fiber orientations by overlaying UD sheets and to the possibility of manufacturing good quality laminates using techniques coming from composite technologies, bamboo laminates result well adequate in boat constructions as well as in a number of other structural applications. As most wooden materials, bamboo presents a consistent water absorption at saturation, exceeding 30% wt. On the other hand, a quite limited variation of tensile strength and modulus was measured (less than 10 %). Moreover, a negligible variation of in-plane dimensions, less than 0.5%, was observed. Bamboo laminates have a remarkable resemblance with fiber composites. Similar production and testing protocols, as well as design methodologies, can be adopted to get structural components which may result valid alternative to traditional fiberglass in a number of nautical elements also considering that, notwithstanding a remarkable water absorption, stable dimensions are observed. Although in the tested materials only a small fraction of synthetic resin was used, the adoption of epoxy from renewable sources can further improve the sustainability of these products, still preserving the remarkable mechanical performances.