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Novel flax composites functionalized by polypyrrole for shipbuilding application

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In this research work novel polymeric composites reinforced with functionalized natural fibers have been produced, in order to replace fiberglass reinforcement in shipbuilding industry. The substitution of glass fibers with ligno-cellulosic fibers brings advantages also in terms of weight of the composites which results lighter than fiberglass ones, moreover it solves the issues linked to the complexity of the disposal procedure and the health risk of fiberglass composites. Different types of technical flax fabrics and felts, having different weight and fibers orientation were used as reinforcement after functionalization by polypyrrole, a conductive organic polymer which confers antistatic and EMI shielding properties, bacterial resistance and good compatibility with non-polar polymeric matrices. Polypyrrole functionalization was carried out by in situ polymerization of pyrrole monomer, using ammonium persulfate as oxidant. The fabrics were dipped in pyrrole and oxidant solutions for 2 hours under mechanical stirring then a polyester resin commonly used in shipbuilding industry was applied on treated fabrics to produce the composites. The composites were characterized for surface functionalization, morphology, thermal and mechanical behavior in order to establish their applicability in shipbuilding industry. Chemico-physical characterization showed that polypyrrole functionalization not affected the compatibility between fabrics and polyester resin. The novel composites exhibit lowest tenacity and elastic modulus than fiberglass but showed comparable specific module, considering the specific density of the materials. Thermal analysis showed that functionalized fabrics degraded at slightly lower temperature but with lower heat release rate of the degradation process. The shift of the degradation temperature resulted more evident with the increase of the amount of polypyrrole on fabrics surface. Moreover, the composites reinforced with flax fabrics showed a significant reduction of the carbon residue which can be traduced into an advantage in terms of disposal by incineration and solves the problem of glass fibers dispersion.

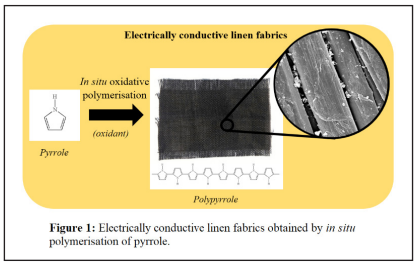

Figure 1: Electrically conductive linen fabrics obtained by *in situ* polymerisation of pyrrole.

Biography

Rosalinda Caringella has been graduated in Chemistry from the University of Turin in 2012. Since 2014, she has been working as Temporary Research Assistant at the Institute for Macromolecular Studies (ISMAC) of the Italian National Research Council (CNR). She has worked on the functionalization of natural fibers, preparation of bio-composites and valorization of wool wastes and extraction of keratin for biomedical, textile and pharmaceutical applications.

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