Grafting of nano-silica onto ramie fiber for enhanced mechanical and interfacial properties of ramie/epoxy composite

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Main Ideas

a) The relatively lower mechanical properties of natural fiber reinforced polymer composites, limits their engineering application.

b) To improve the bonding between natural fibers and polymer matrix is an effective way to enhance the mechanical properties of NFRP, e.g., silane coupling treatment.

c) Grafting of nanoparticles (i.e., nano-silica) onto natural fibers is assumed to be helpful in the bonding properties.

d) The natural fiber surface grafting of nano-silica is proposed to be realized with silane coupling to form covalent bonds.

e) The effects of grafting of nano-silica on the bonding strength and mechanical properties are tested.

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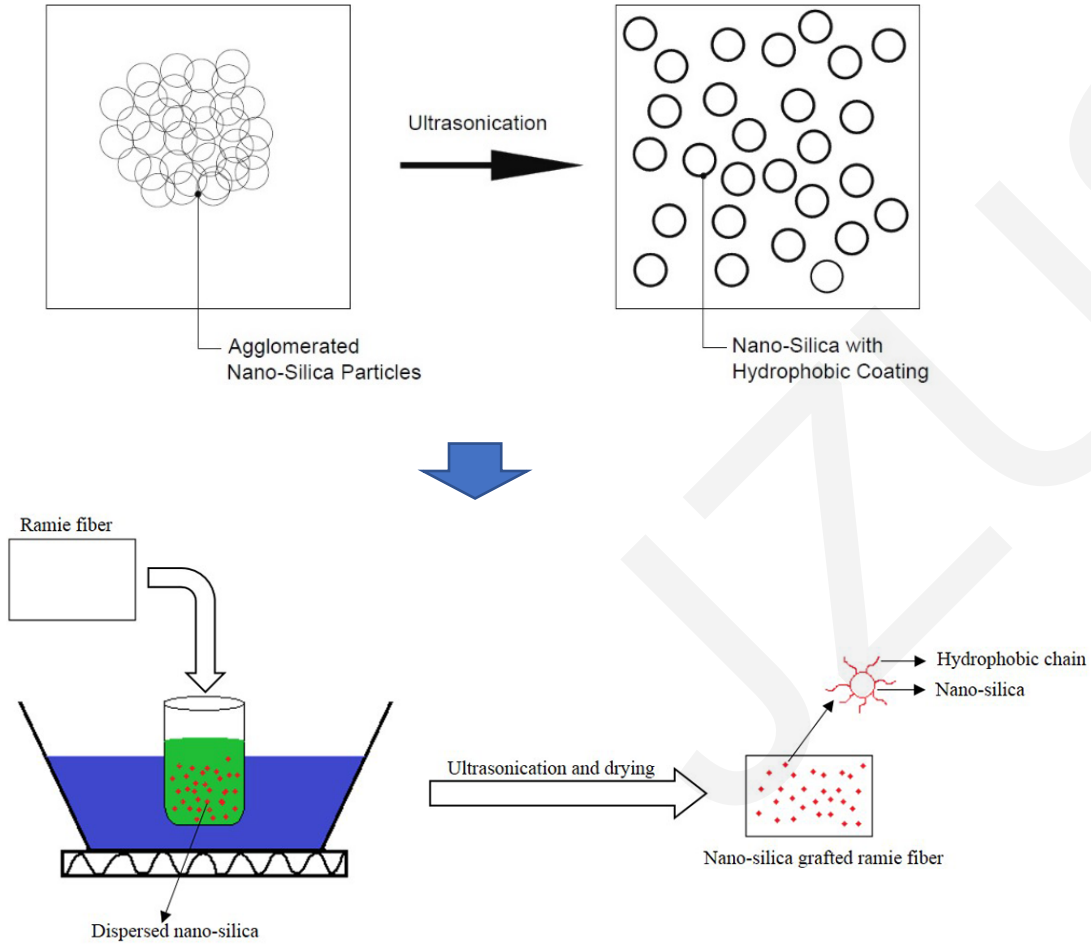
Method of nano-silica grafting onto ramie fibers and NFRP sample preparation

Grafting Method



NFRP sample preparation



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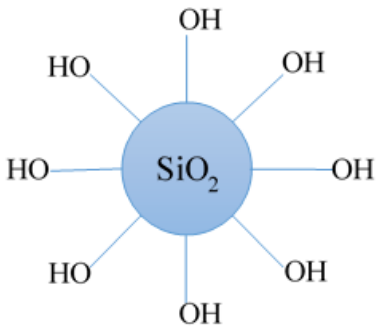
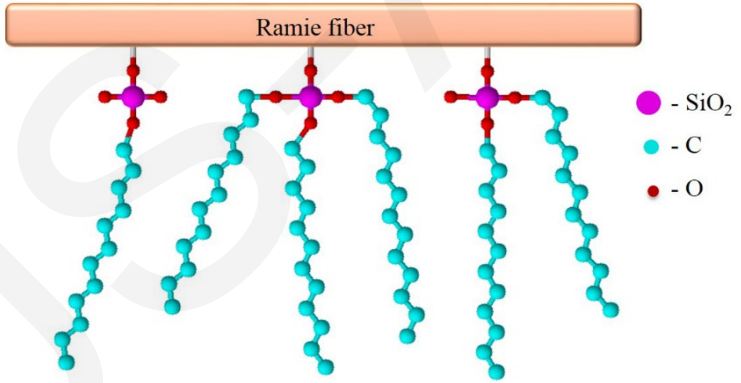
Method of nano-silica grafting onto ramie fibers

Grafting Mechanisms



SDS



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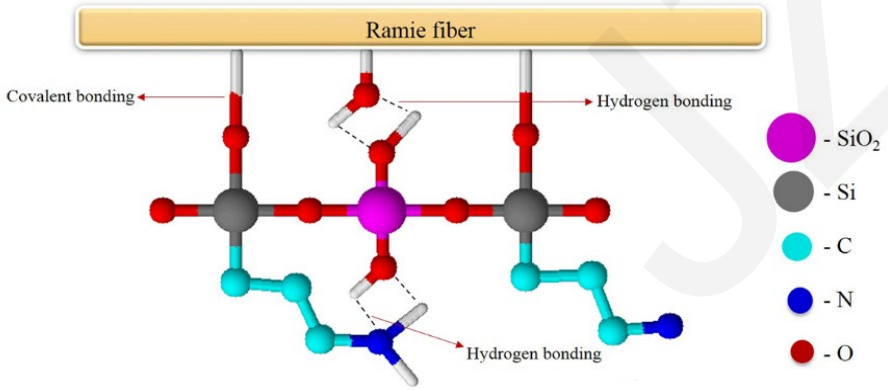
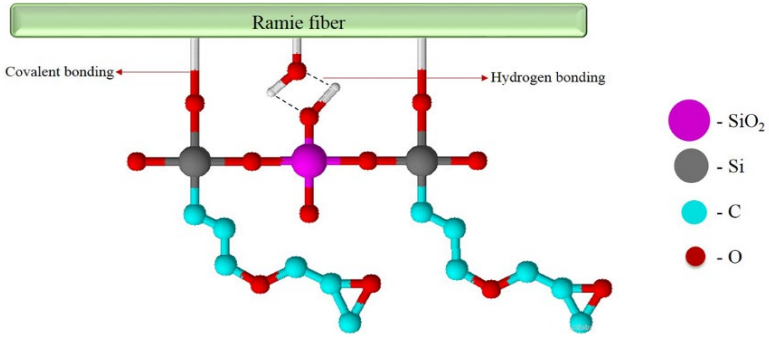
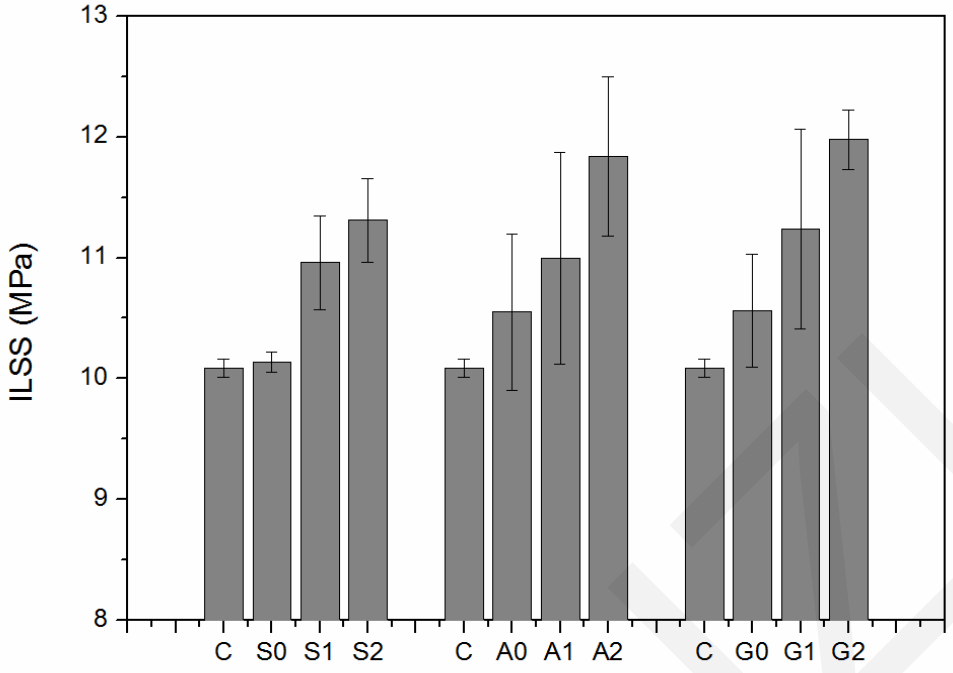
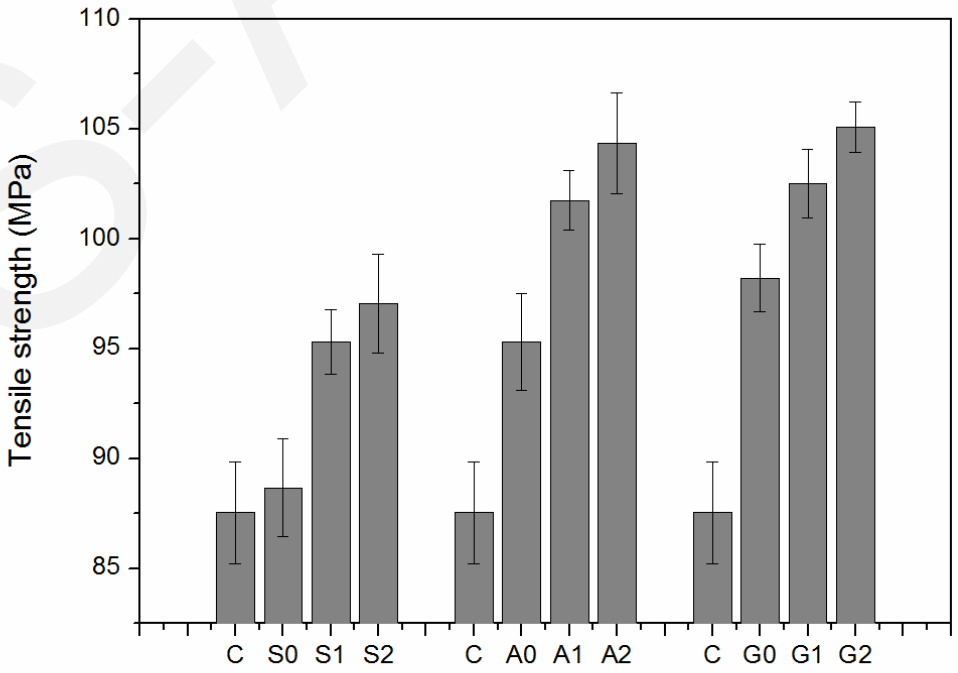


GPS



Effects of nano-silica grafting on the bonding and mechanical properties ramie fibers





Enhanced bonding strength

Enhanced tensile strength of ramie/epoxy composites

Conclusions

a) The ramie fiber was grafted with modified nano-silica on the fiber's surface with the proposed method assisted with silane coupling agent.

b) The surface roughness of the fibers increased considerably after grafting nano-silica on its surface.

c) The hydrophilicity of the treated fiber was reduced by grafting nano-silica onto its surface.

d) The nano-silica particles on the fiber's surface improved the bond strength between the fiber and epoxy matrix, which resulted in an enhancement of the mechanical and thermal properties of the composites.

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