

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

Anna DILFI K. F.^{1,2,3}, Zi-jin CHE^{1,2,3}, Gui-jun XIAN^{1,2,3}

¹*Key Lab of Structures Dynamic Behavior and Control of the (Harbin Institute of Technology), Ministry of Education, Harbin Institute of Technology, Harbin 150090, China*

²*Key Lab of Smart Prevention and Mitigation of Civil Engineering Disasters of the Ministry of Industry and Information Technology, Harbin Institute of Technology, Harbin 150090, China*

³*School of Civil Engineering, Harbin Institute of Technology, Harbin 150090, China*

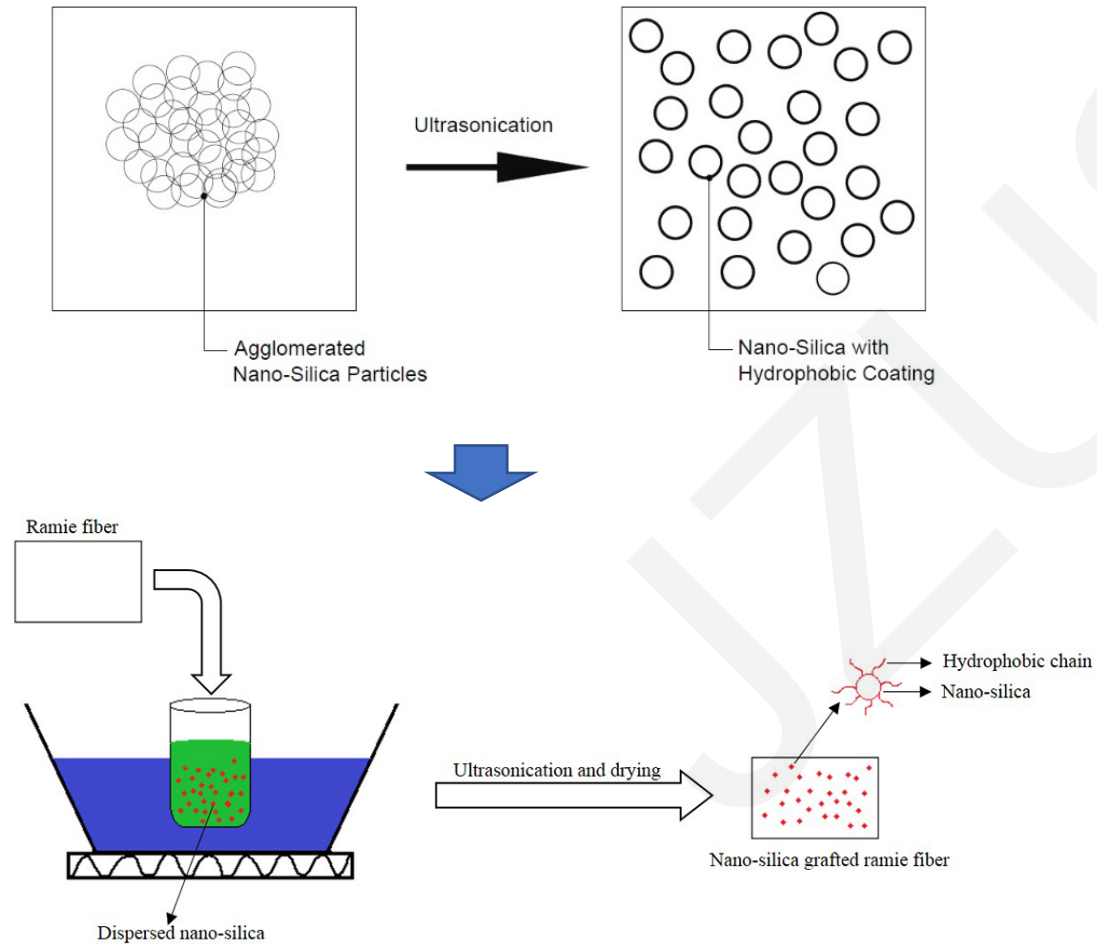
Cite this as: Anna Dilfi K. F., Zi-jin Che, Gui-jun Xian, 2019. Grafting of nano-silica onto ramie fiber for enhanced mechanical and interfacial properties of ramie/epoxy composite. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 20(9):660-674. <https://doi.org/10.1631/jzus.A1900186>

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.

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

Grafting Method

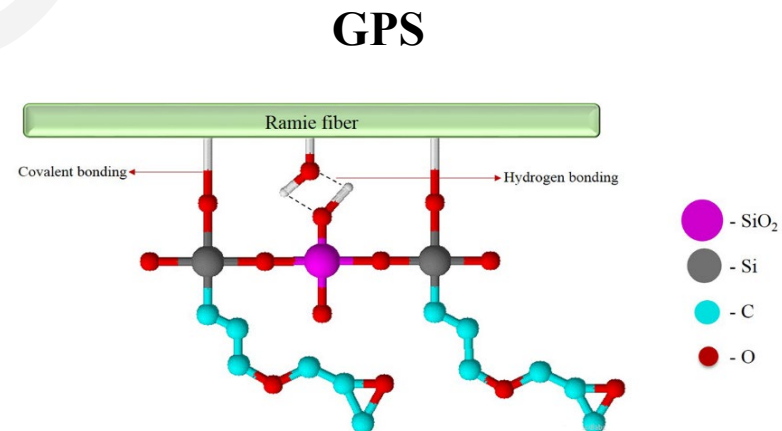
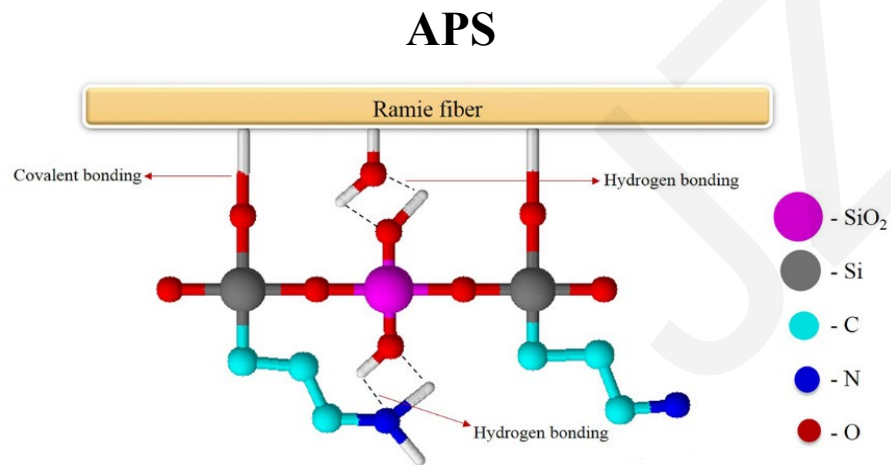
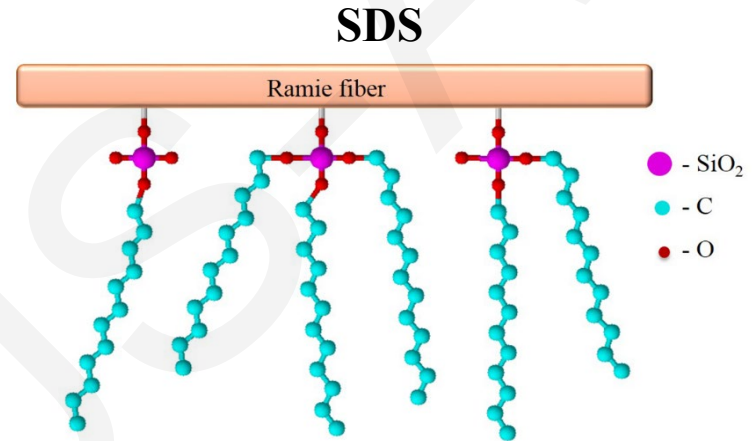
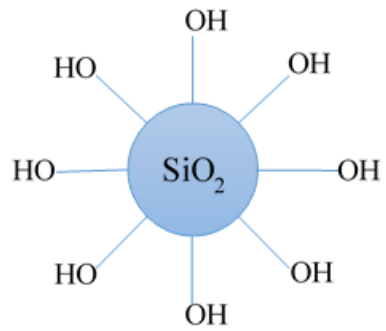


NFRP sample preparation

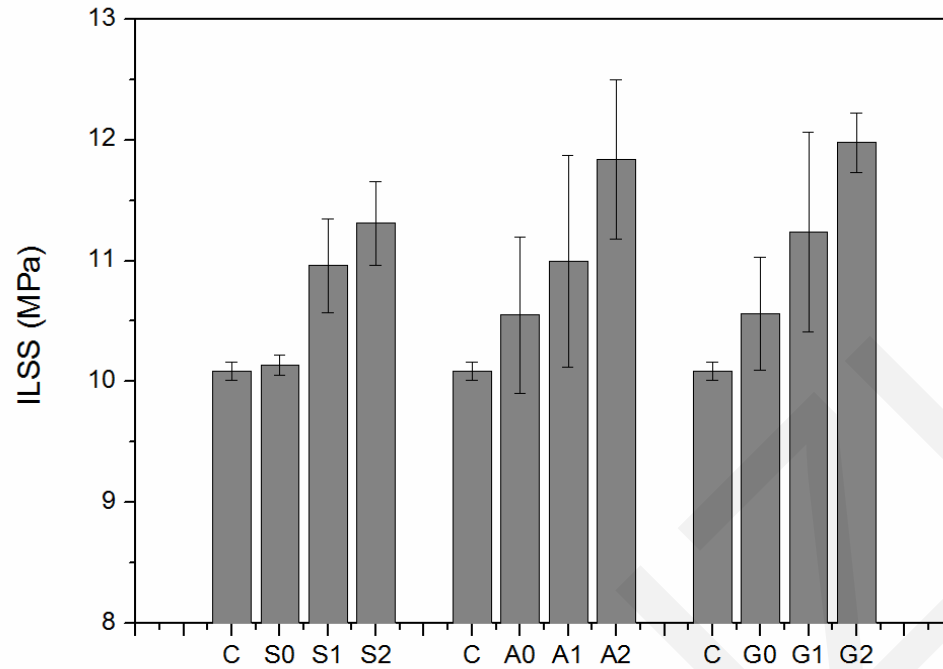


Method of nano-silica grafting onto ramie fibers

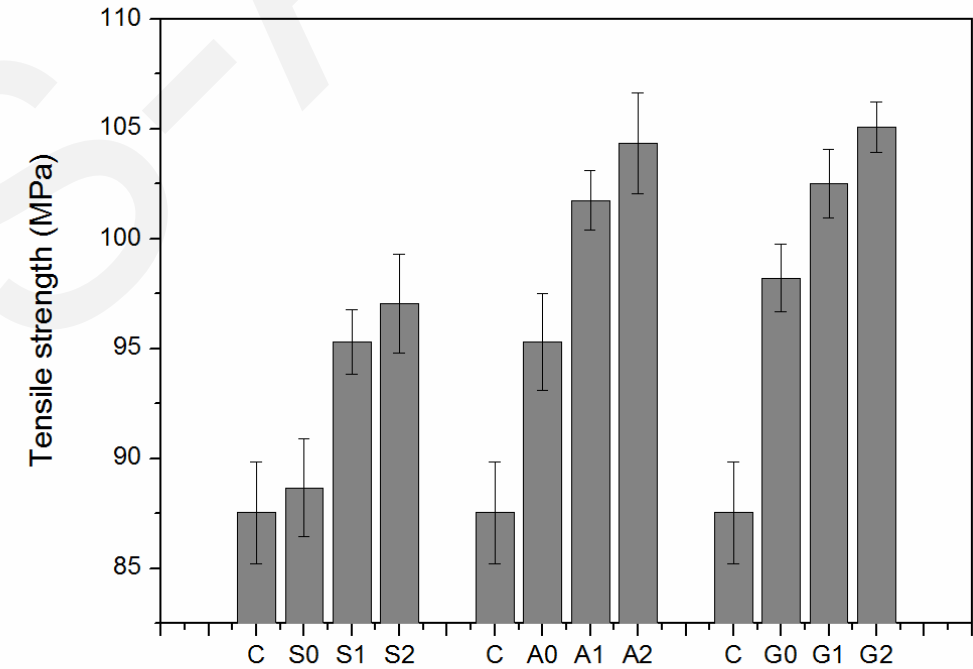
Grafting Mechanisms



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.