

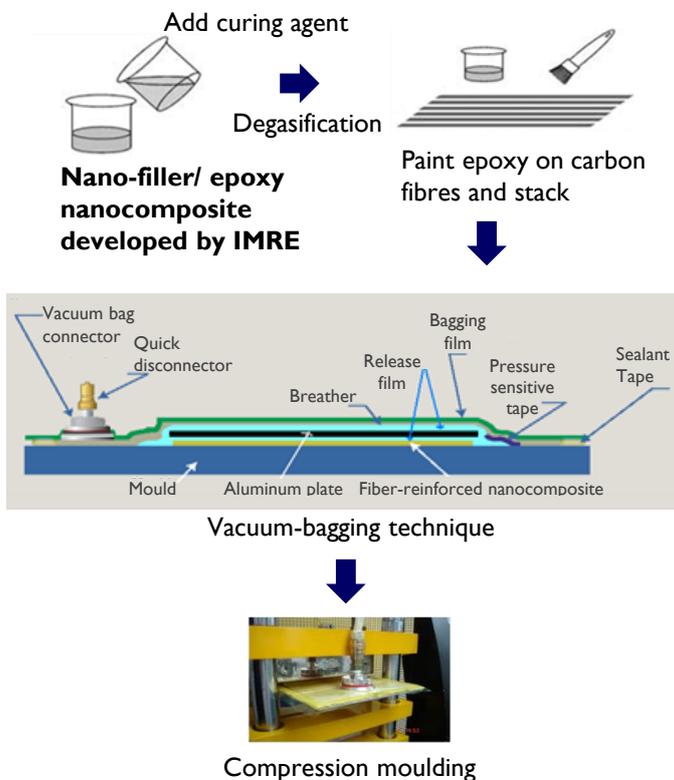
High Strength, High Impact Thermosets

The Challenge

The incorporation of fillers, in normal circumstances, can significantly increase the strength of thermosets, but will compromise the impact resistance. To overcome this crucial material challenge, IMRE has developed advanced fillers and thermoset processing technologies to develop high strength thermoset materials without compromising impact resistance.

Fabricating thermoset laminates

The fabrication process comprises a wet lay-up process, followed by a curing process carried out using the vacuum-bagging technique under high pressure, and finally a compression moulding process to produce the thermoset laminates.



Key Features

- One filler, multiple functions
- High strength, light weight
- High impact resistance
- Good corrosive resistance
- Low filler content leading to easy processability
- Tunable and uniform filler size to achieve good dispersion in polymer matrix

Potential Applications

- Structural composites for extreme applications
- Fabrication of “Pre-Preg” and laminates, reinforced with carbon, glass or natural fibres
- Aerospace (engine blades)
- Windmill
- Car-body structure
- Interior wall panels
- Sport equipment, e.g. tennis racket

Collaboration Opportunities

We have the capability to work with you to:

- Design and synthesize fillers and additives
- Enhance filler-matrix interface
- Design and modify formulations
- Conduct processability studies using resin transfer moulding, compression moulding, lamination and coating



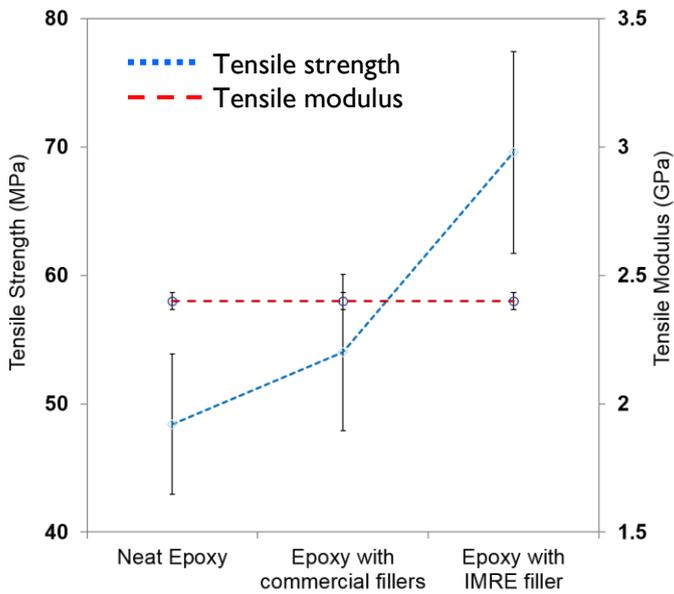
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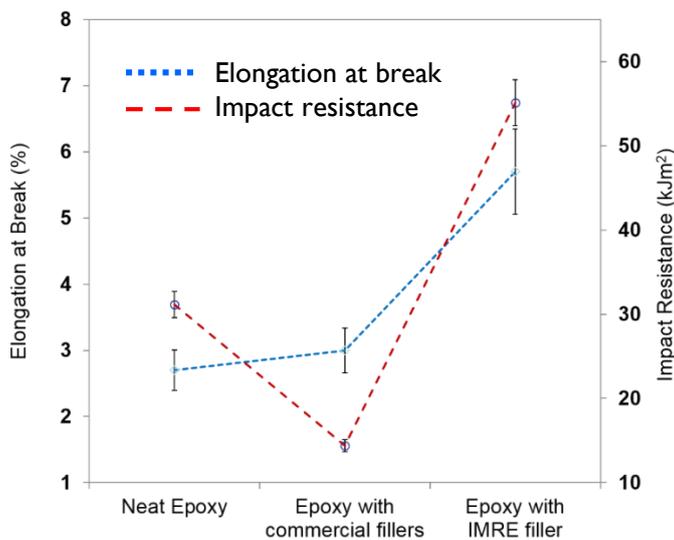
IMRE website: <https://www.a-star.edu.sg/imre/>
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Performance Data



Maximum tensile strength increases by almost 50% with the addition of 1wt% of IMRE filler into epoxy (thermoset) matrix while the stiffness (tensile modulus) of the thermoset composite is maintained.



Toughness (elongation at break) increases by almost 110%

Impact resistance increases by almost 80%

IMRE filler improves strength of thermoset materials without compromising impact resistance.

The addition of the developed POSS-Rubber filler (IMRE filler) significantly improves both the tensile strength and toughness (demonstrated by elongation at break and impact resistance) of epoxy (thermoset material). With the addition of 1 wt% of IMRE filler, the impact resistance increased almost 80 %, toughness increased 110 %, and tensile strength 50%, as compared with neat epoxy, while the stiffness (tensile modulus) is maintained.

The experiment results also suggest that the epoxy incorporated with IMRE fillers demonstrates enhanced mechanical properties as compared with epoxy incorporated with commercial fillers. Therefore, the fillers developed at IMRE can potentially be an excellent alternative towards the development of high strength and high impact resistant thermoset materials.