Supergen

Submerged bi-axial fatigue analysis for flexible membrane Wave Energy Converters

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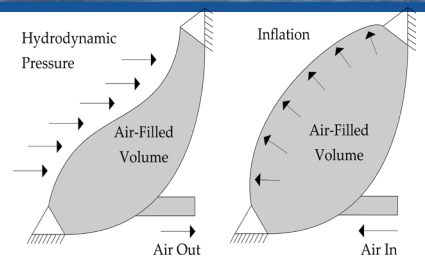
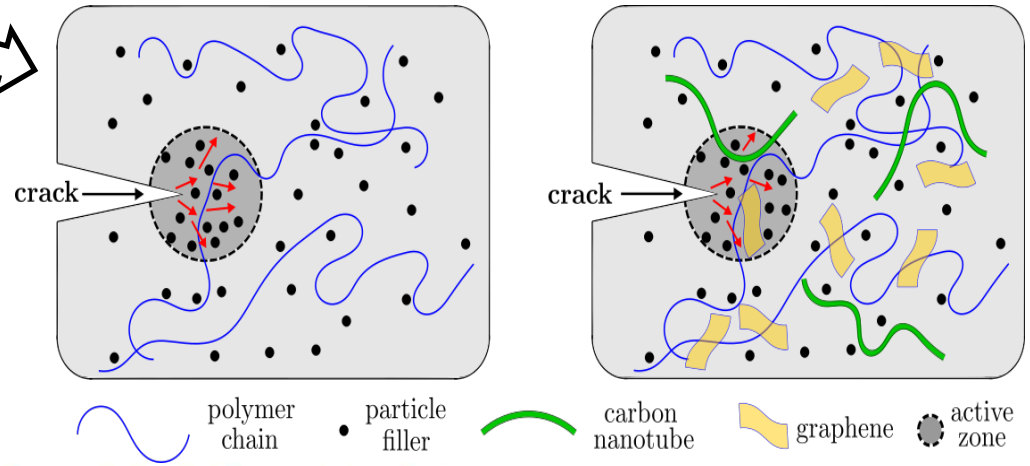
Application, Aims & Objectives



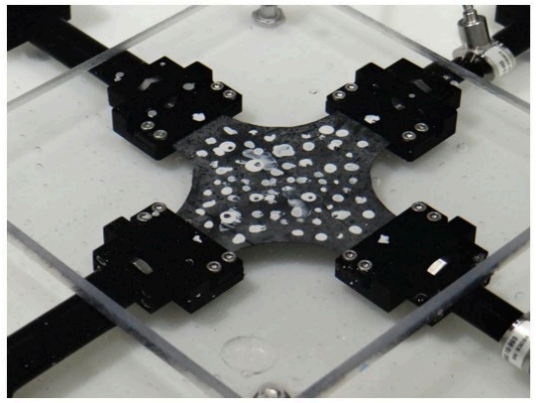
- Rubber-like materials are used in flexible membrane-based Wave Energy Converters (mWECs).

Aim 1: To synthesize CNT/Natural Rubbers(NRs) to achieve proper mechanical properties, e.g., ultra-low dissipative energy behaviour and high fatigue life

State of CNTs dispersion is of importance



Fatigue life enhancement around 40%-100% compared to carbon black-filled natural rubbers.



Aim 2: To conduct biaxial fatigue experiments in dry and submerged conditions mimicking sub-sea environments.

Methodology: MB Preparation

(1) Cutting SMR CV60 into small pieces.

(2) Dissolving CV60 into toluene.

(3) Coagulation of some CV60 resulting in presence of lumps.

(4) Mechanical stirring for better homogenization.

(5) Adding CNTs into NR/ toluene mixture.

(6) Drying CNTs-CV60/toluene in a tray.

(7) Peeling off the CNT/NR film from the baking paper.

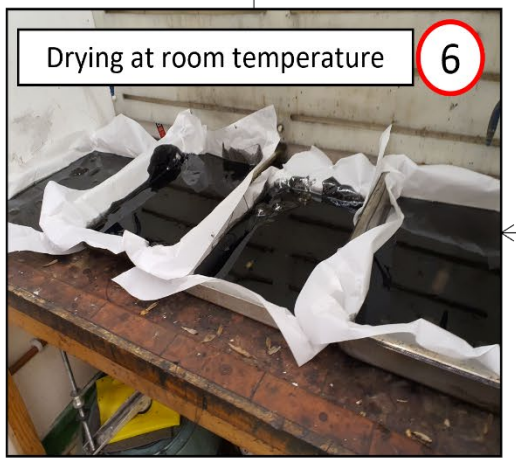
(8) MB lumps ready to be milled.

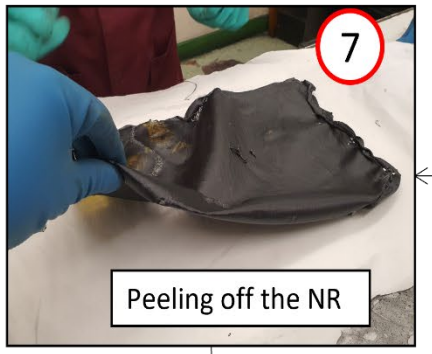
(9) Further homogenization of NR/CNTs using two-roll mill.

(10) MB

Dissolving NR into toluene-3 days

After 2 day

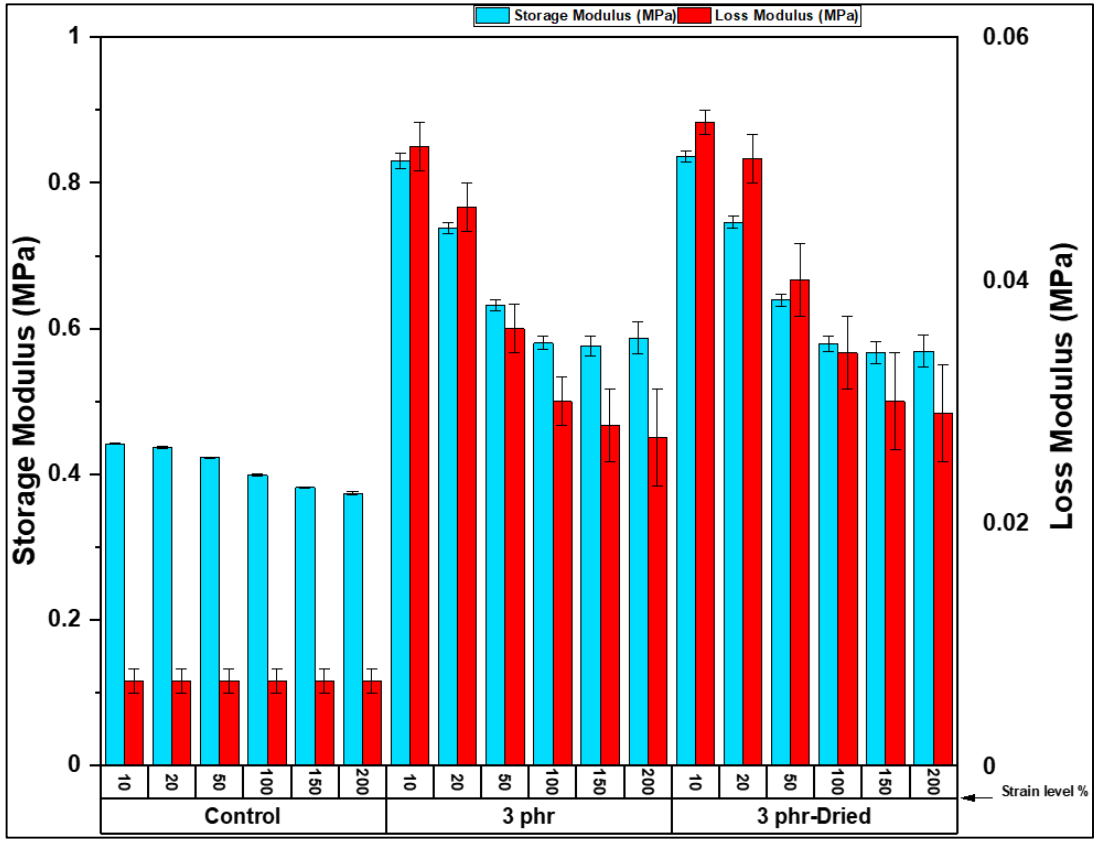


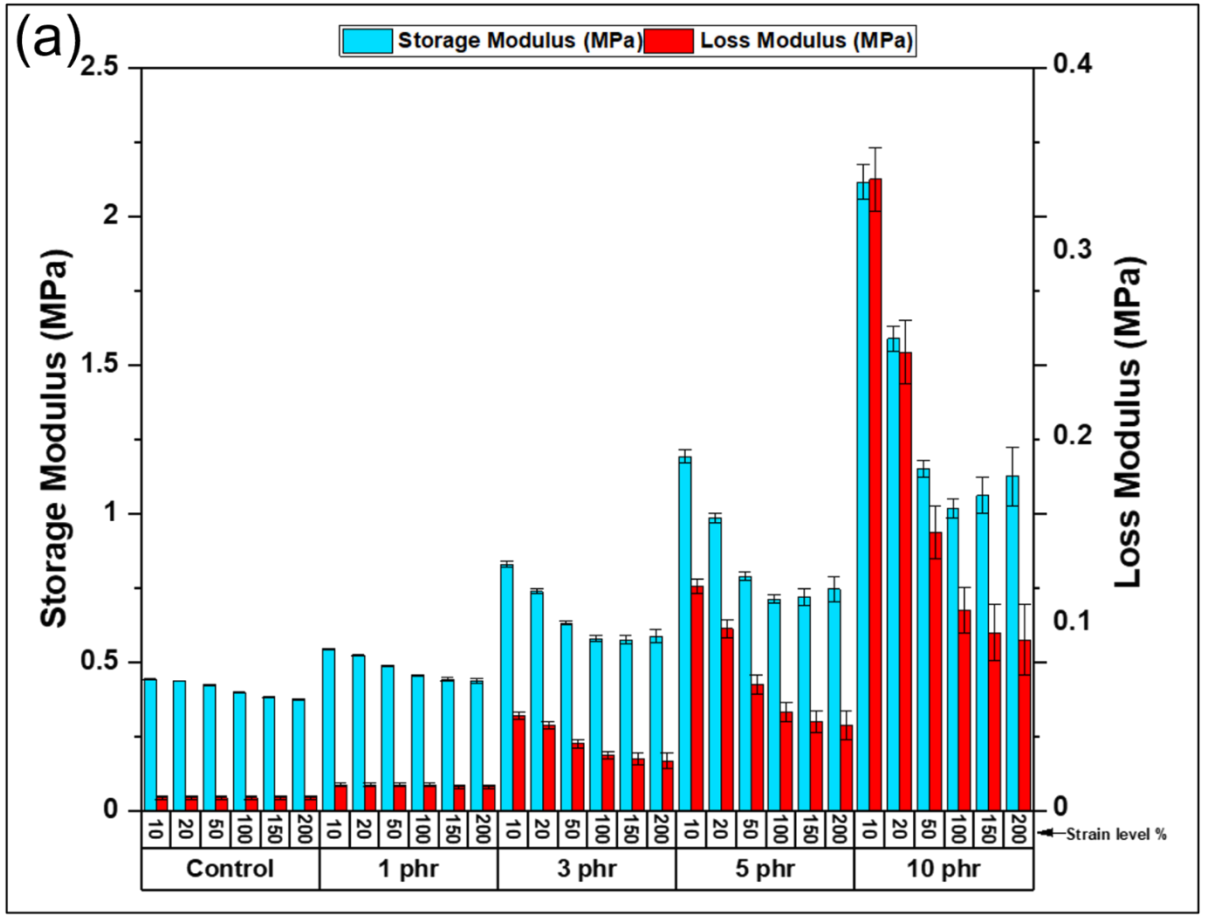


NR/CNT master batch (MB) 10 phr

Results: The Effect of CNTS on Storage and Loss Moduli

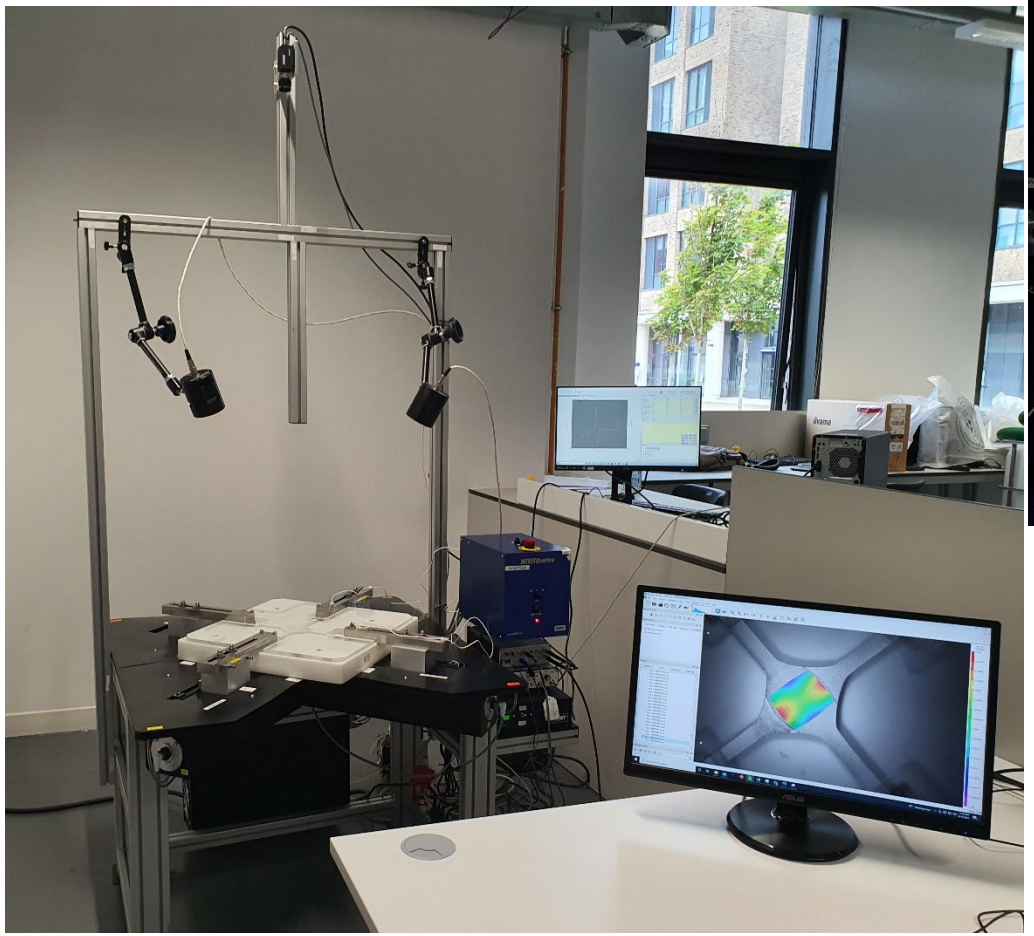
- Incorporation of CNTs into NR increases storage and loss moduli.
- Addition of CNTs increases the damping capability of the compound.
- Dry dispersion showed relatively higher loss modulus compared to the wet dispersion technique



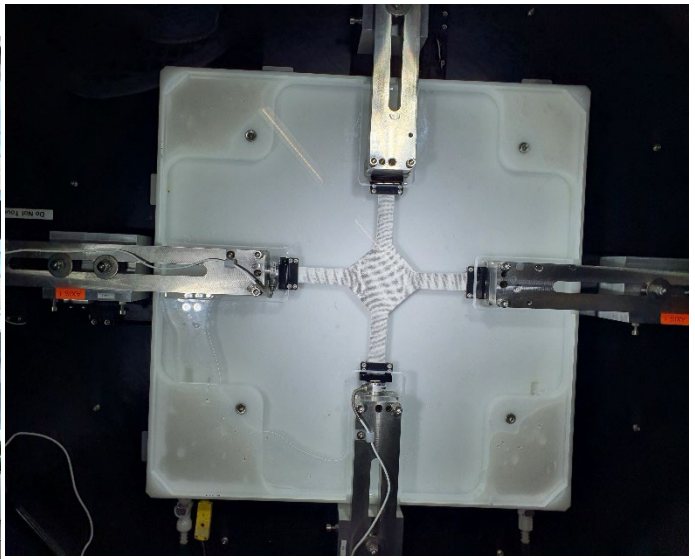


Methodology: Biaxial Machine

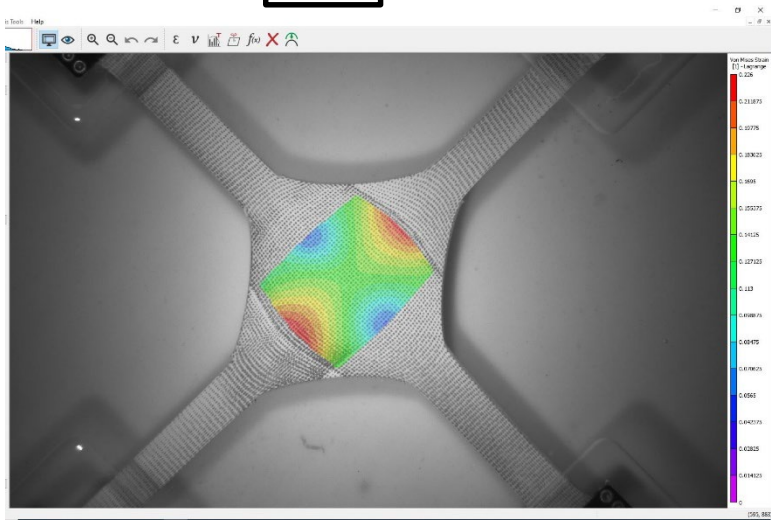
Biaxial rig



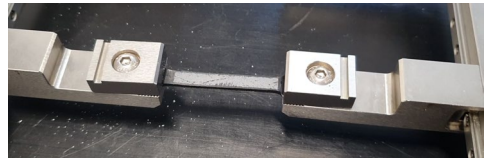
Submerged test



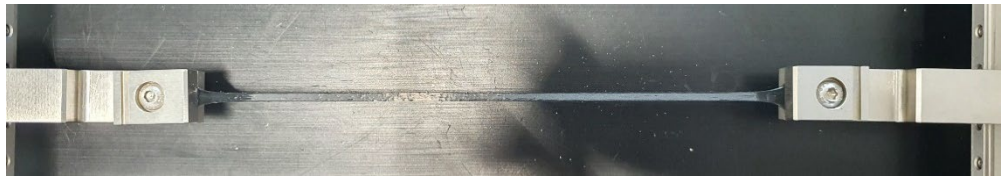
DIC



Before test

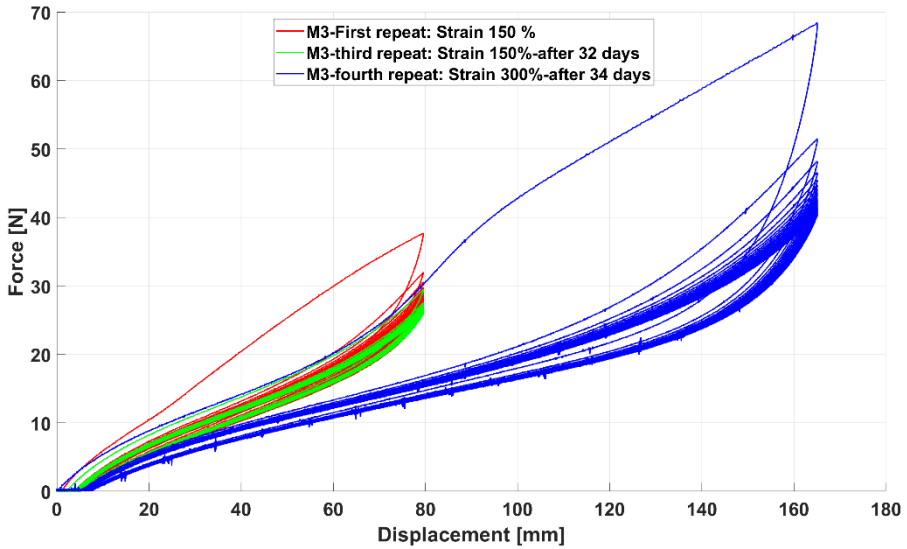


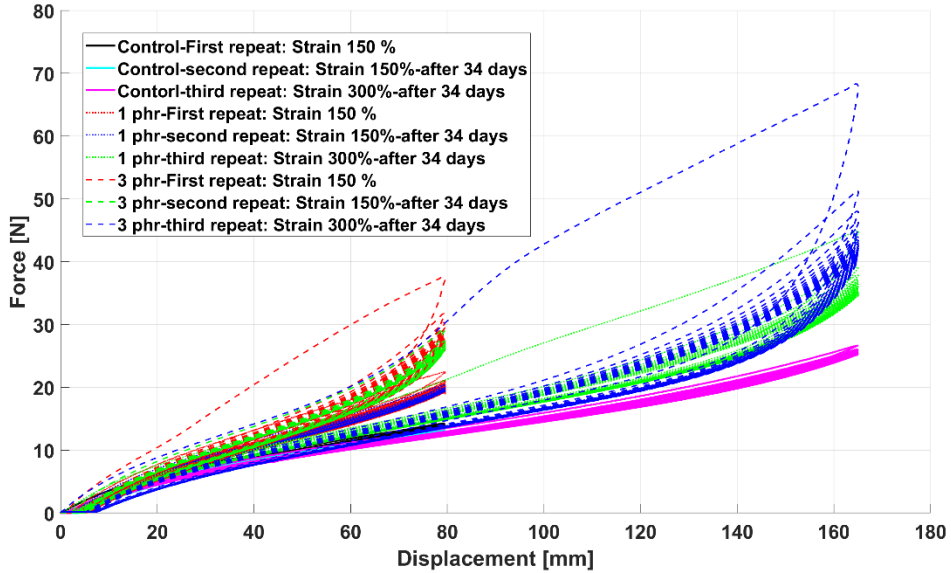
strain: 500 % test



Results: Viscoelastic characterizations

Control did not show any Mullins behavior whereas the nanocomposite rubbers manifested pronounced Mullins behavior





Addition of CNTs enhanced tensile properties and hysteresis loss with respect to pure rubber.