Development of Natural Rubber Graphene Nanocomposite Foam

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In pursuit of a multifunctional polymer composite, the use of diverse materials, as well as the selection of design and fabrication methods, has been explored. However, optimising the material's functionality is a crucial aspect that often gets compromised by mass or space constraints. To address this issue, the optimisation of functionality through the integration of functional polymer composites with traditional foaming processes presents a promising avenue for advancement in materials research. Herein, we have used chemical foaming in a bio-based NR rubber system and GNP to tune the foam functionality. To explore the structural properties relationship of the NR foam with graphene loading properties over different aspects. Optimal loading of graphene and foaming yield a foam with a density of 0.34 g/cc. It exhibits excellent recoverability and a 5-fold increase in compressive modulus compared to the pure one. With GNP functionality and foam, the material shows an EMI shielding of 9.14 dB but is expected to show an SSE of 94.1 dB.cm^2/g, making it suitable for a lightweight EMI shielding solution. Due to its high dielectric properties and porous structure, it can generate energy as a component of a triboelectric generator. It exhibits a power density of 4.13 W/m^2 at 10 MΩ, demonstrating a next-generation energy-harvesting solution. The foam, with its various application-oriented advancements and porous structure, results in a lightweight multifunctional polymer composite.

References

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Figures

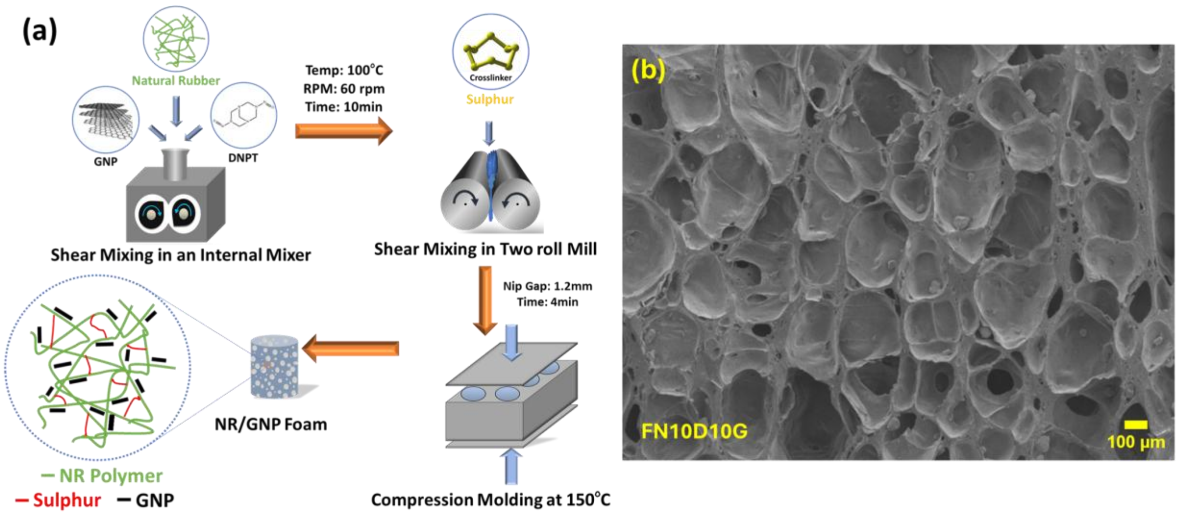

Figure 1: (a)Schematic Diagram of fabrication for the Natural Rubber Graphene Nanocomposite Foam (b) SEM image of cell morphology of NR/GNP foam at 10 phr of filler loading