

Rheological Behavior Of Poly(Styrene-Co-Acrylonitrile)/Carbon Nanotube Sponges Doped For Fiber Electrospinning

Rubén Caro^{1,2}, Marco Antonio Pérez¹, Hugo Martínez³, Lazaro Ruiz¹, Gabriela Martínez¹, Mónica Corea¹ and Emilio Muñoz⁴

¹Escuela Superior de Ingeniería Química e Industrias Extractivas (ESIQIE) IPN, Mexico, ²Escuela Superior de Ingeniería Mecánica y Eléctrica (ESIME) Zacatenco IPN, Mexico, ³Centro de Nanociencias y Micro-Nanotecnologías (CNMN), IPN, Mexico, ⁴Instituto Potosino de Investigación Científica y Tecnológica, División de Materiales Avanzados, Mexico.

INTRODUCTION

This study investigates the influence of carbon nanotube sponges (CNT-sponges) at concentrations of 0.1, 0.3, and 0.5 wt% on the rheological behavior of three series of poly(styrene-co-acrylonitrile) P(S:AN) polymer solutions with 0:100, 20:80, 40:60 and 50:50 monomeric concentration. Amplitude sweep tests were performed to evaluate the Linear Viscoelastic Range (LVER), storage modulus (G'), loss modulus (G''), structural behavior, and overall homogeneity of the composite solutions. This will be a good insight for the electrospinnability of dopes.

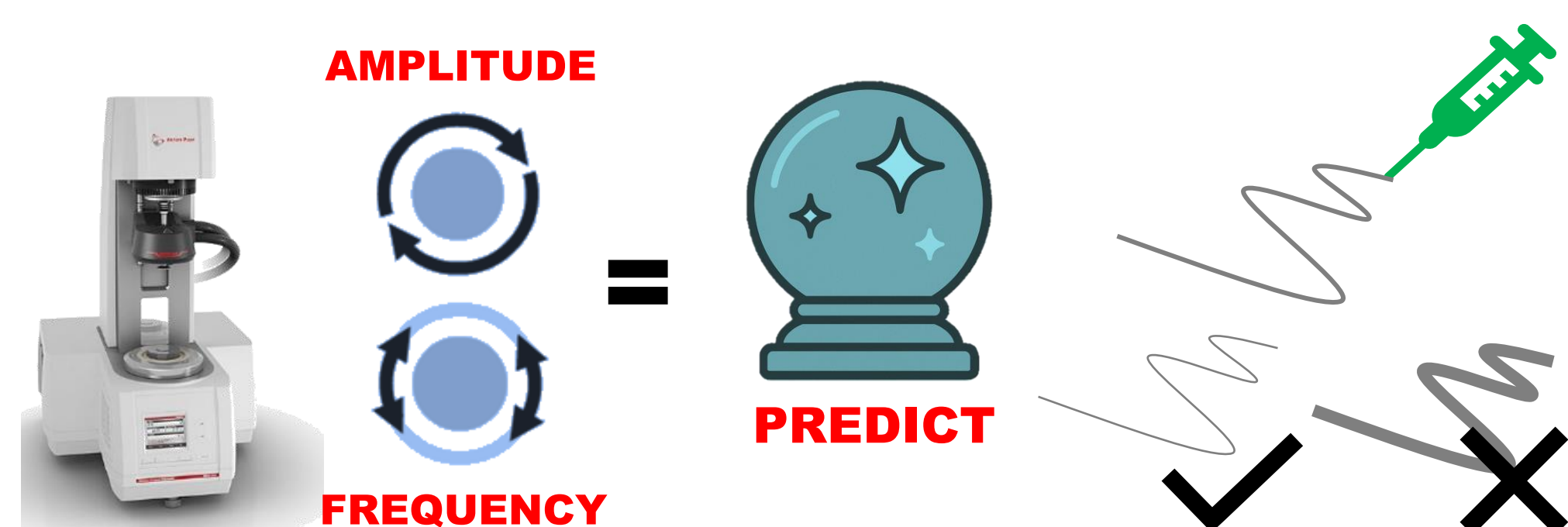


Figure 1. General scheme of the project's aim.

METHODOLOGY

DOPES PREPARATION

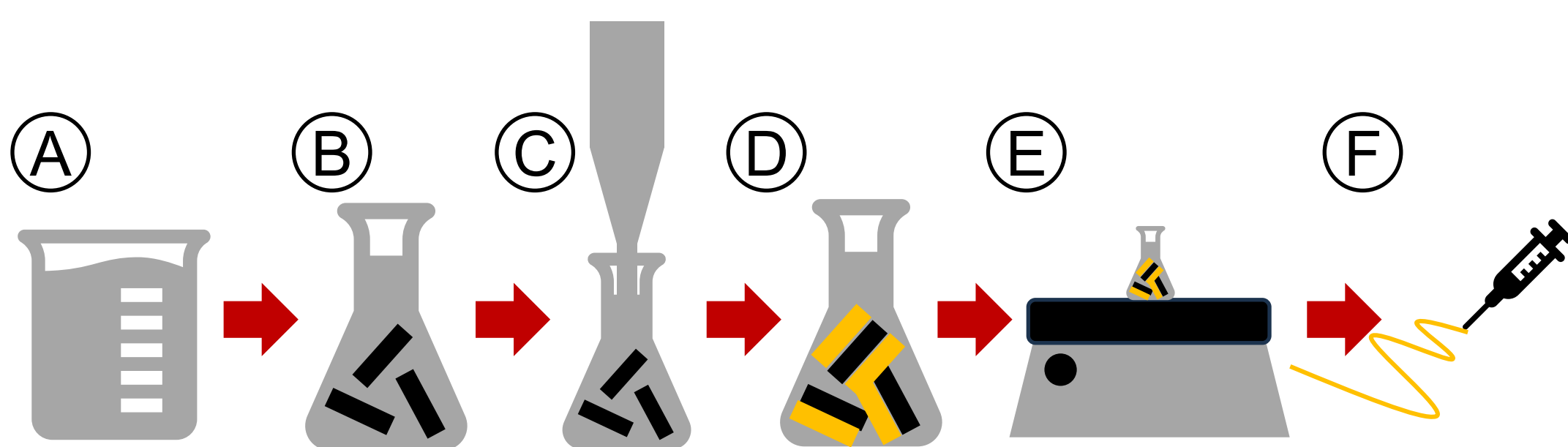


Figure 2. Scheme of method used for all dopes preparation: **A.** Add N,N-Dimethylformamide, **B.** Add CNT-sponges, **C.** Sonication process (2 h), **D.** Add poly(styrene-co-acrylonitrile), **E.** Mechanical stirring (12 h, 80°C), **F.** Electrospun fibers (18 kV, 8 cm, 1mL/h).

RHEOLOGY CHARACTERIZATION

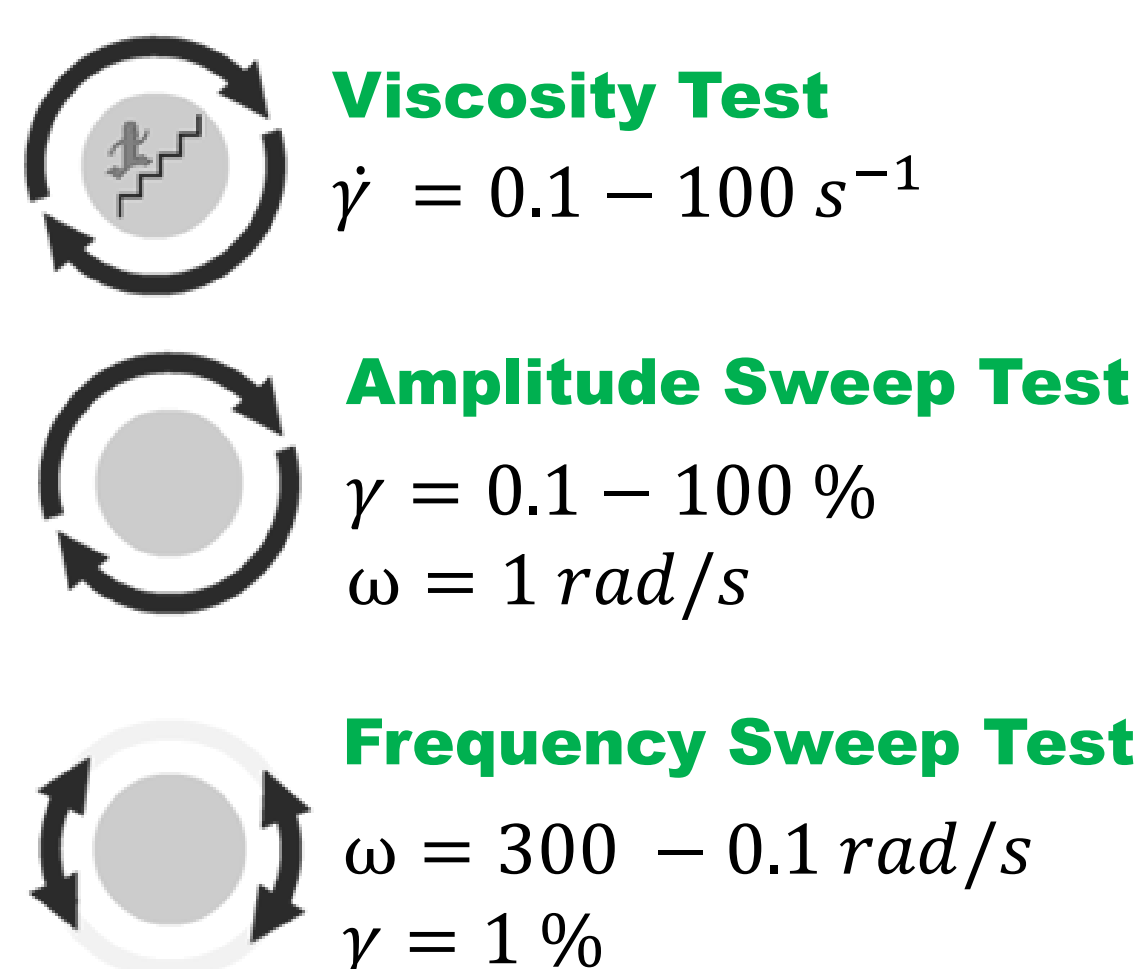


Figure 3. Parameters used for rheology characterization. ($\dot{\gamma}$) shear rate, (γ) shear stress, (ω) angular frequency.

SCAN ME



MORE INFO

RESULTS & DISCUSSION

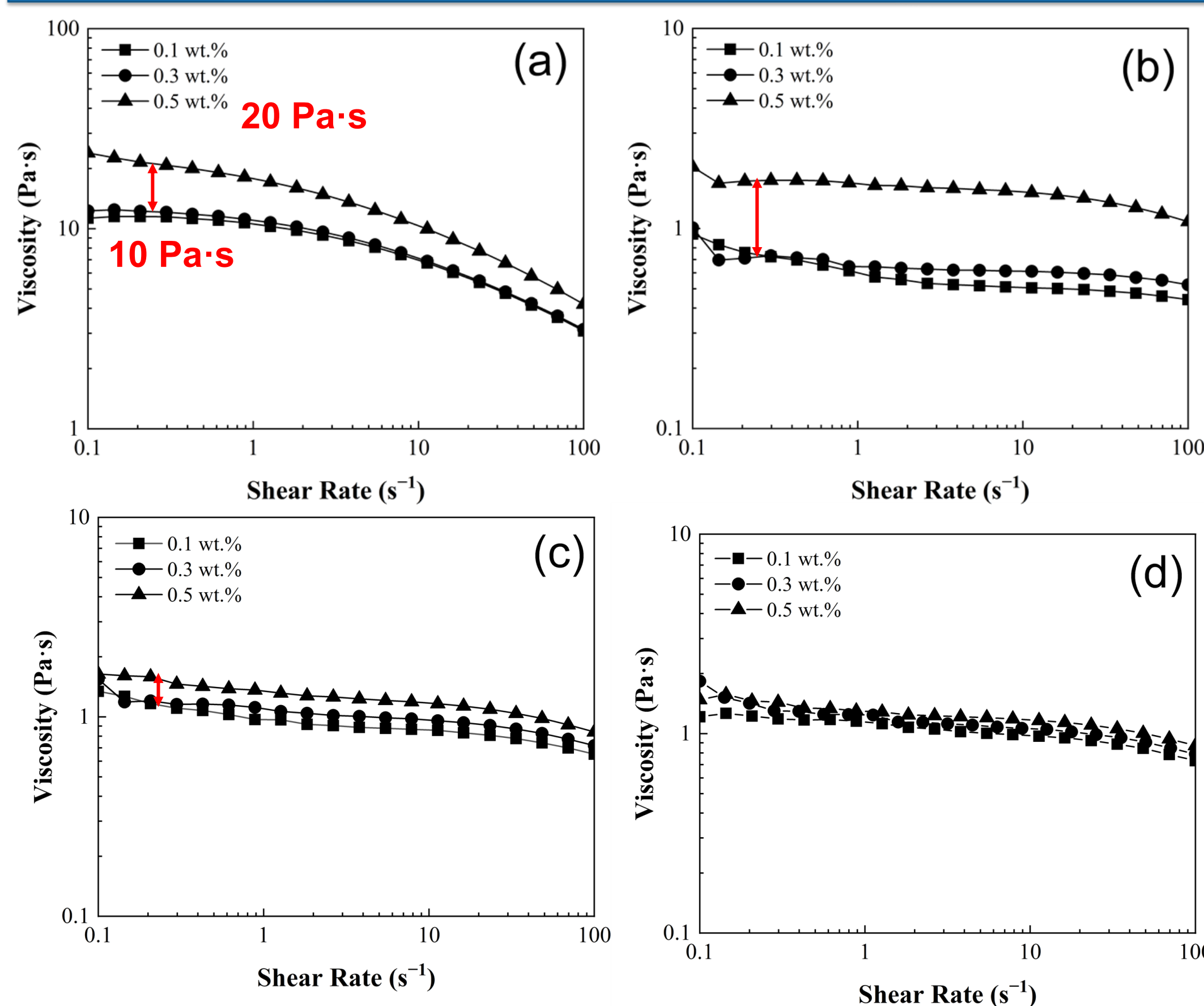


Figure 4. Viscosity curves as a function of shear rate of dopes at different polymeric concentrations: (a) 0:100, (b) 20:80, (c) 40:60 and (d) 50:50 wt%:wt% P(S:AN).

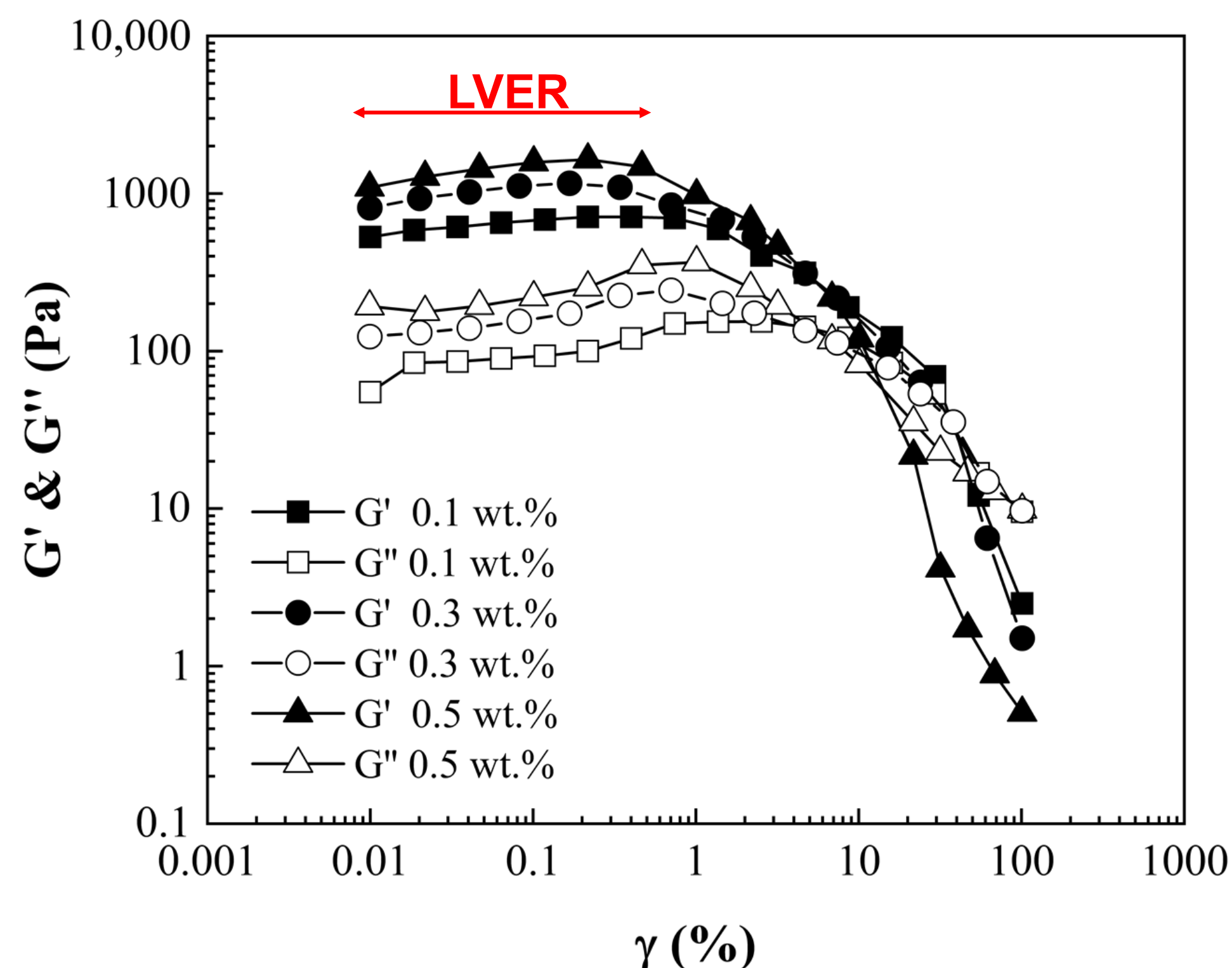


Figure 5. Amplitude sweeps dopes 0:100 wt%:wt% dopes, γ limit 1 %.

CONCLUSIONS

- CNT-sponges concentration of 0.1 and 0.3 wt% presents suitable rheology parameters for electrospun. Viscosity (10 Pa·s), LVER ($\gamma=1\%$), solid-like behavior and $G'>G''$.
- Amplitude and frequency sweeps, flow and viscosity curves, and loss factor parameters successfully predicted the suitability of dopes for electrospinning.

REFERENCES

Caro, R., Pérez, M. A., Martínez, H., Muñoz, E., Martínez, G., Ruiz, L., & Corea, M. (2025). Rheological Behavior of Poly(Styrene-Co-Acrylonitrile)/Carbon Nanotube Sponges for Fiber Electrospinning Applications. *Nanomaterials*, 15(14), 1060.