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Monofilament Melt Spinning of PET-based Antistatic Composite Fibers with Hybrid Fillers

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INTRODUCTION & AIM

- Metals can form composites with polymers, imparting enhanced or unique functional properties.
- Most previous studies have focused on electrically conductive polymer composites made via injection molding, hot pressing, or 3D printing but limited research exists on producing electrically conductive polymer-metal fibers, especially on a larger scale.
- The aim of the current study is the development of electrically conductive fibers which achieves electrical conductivity in the range of electrostatic materials.
- The idea is to use the additive content as low as possibe to have good strength and economical fibers.

METHOD

Polymer

Compounding with additive

Spun fibers

Applications

RESULTS & DISCUSSION

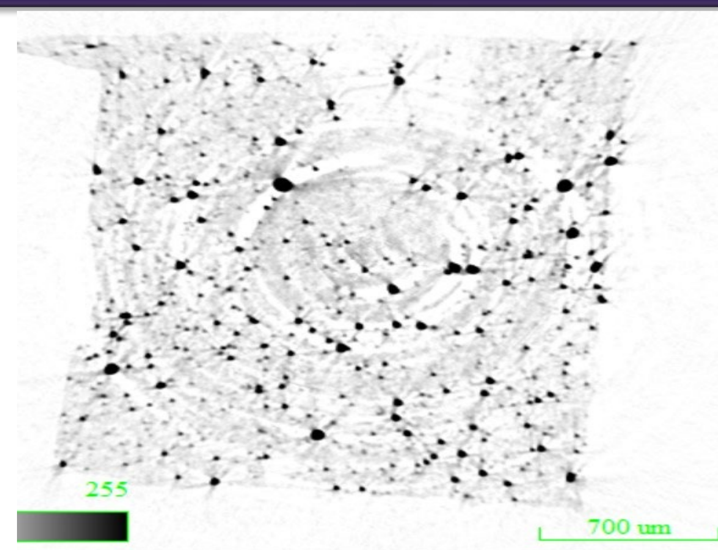

Figure 1: Micro-CT of PET with conductive additive, white: polymer, black: additive

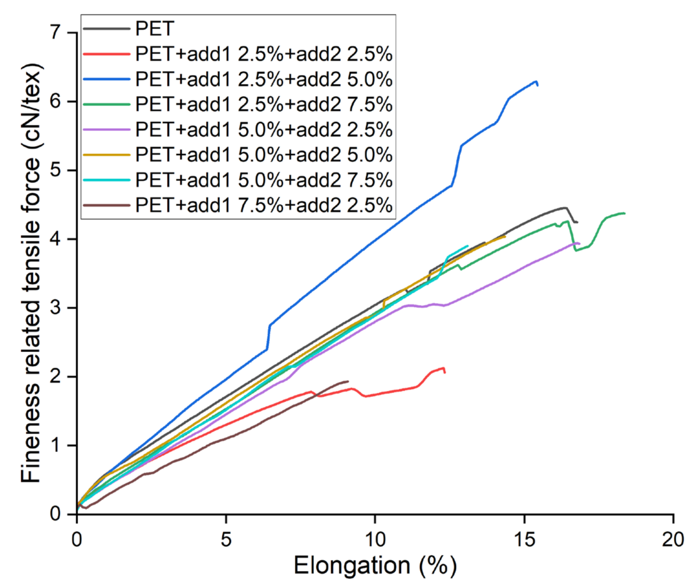

Figure 2: Effect of different additive concentrations on the mechanical properties of PET fibers

CONCLUSION

- Metal additive was well dispersed within the polymer matrix.
- The metal content was limited to 10 wt%, significantly lower than the state-of-the-art 25 wt%, resulting in lower cost and improved fiber strength.
- Molecular weight degradation was observed starting from 5 wt% metal loading, a phenomenon not reported in previous studies.
- PET sample with addtitive1 2.5% and additive2 5% exhibited highest tenacity, indicating optimal mechanical strength among all compositions, while higher additive contents led to a decline in performance.
- The electrical resistance of the composite fibers was lower than that of pure PET fibers, falling within the antistatic range (~10^{10} Ωm).

FUTURE WORK / REFERENCES

- Possibilities of scale up in future.
- Higher spinning speed and higher drawing at the bigger scale would be expected to result in enhanced fibril formation.

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- [2] K. K. Fu et al., “Conductive textiles,” Engineering of High-Performance Textiles, pp. 305–334, Jan. 2018.
- [3] Weise, B. A et al., Pilot-scale fabrication and analysis of graphene-nanocomposite fibers. Carbon, 144, 351–361, 2019.

ZIM Zentrales Innovationsprogramm Mittelstand