BRAZILIAN POLYMER CONFERENCE
Campos do Jordão/SP - Brazil
October 19th to 23rd
2025

ENHANCING CREEP RESISTANCE IN LIMONENE-BASED POLYMER VIA METAL COORDINATION

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Abstract-Metal coordination is reported as an effective strategy to enhance high-temperature creep resistance, a common challenge in vitrimeric materials, which are susceptible to creep.[1,2] Vitrimers are a novel class of polymeric materials that combine the properties of thermosets and thermoplastics.[3,4] These materials have attracted significant interest due to their recyclability, aligning with the United Nations Sustainable Development Goals (SDGs), specifically goals 9 (Industry, innovation and infrastructure), 12 (responsible consumption and production), and 13 (climate action). In this study, a new limonene-derived polymer (PLT) was synthesized via photopolymerization with triallyl isocyanurate (TAIC) under UV light. Metal-coordinated vitrimers were obtained by incorporating 0.5 wt% copper acetate (PLT-Cu 0.5) and 0.5 wt% zinc acetate (PLT-Zn 0.5) into the PLT monomeric mixture. Then, the photochemical reactions were carried out under UV light (365 nm). Tensile creep time-temperature superposition (TTS) analysis demonstrated that metal coordination enhances creep resistance, with PLT-Cu 0.5 exhibiting the most pronounced effect (Fig. 1). Additionally, luminescent properties, along with thermal properties, were influenced by the presence of metal coordination bonds in the polymer matrix.

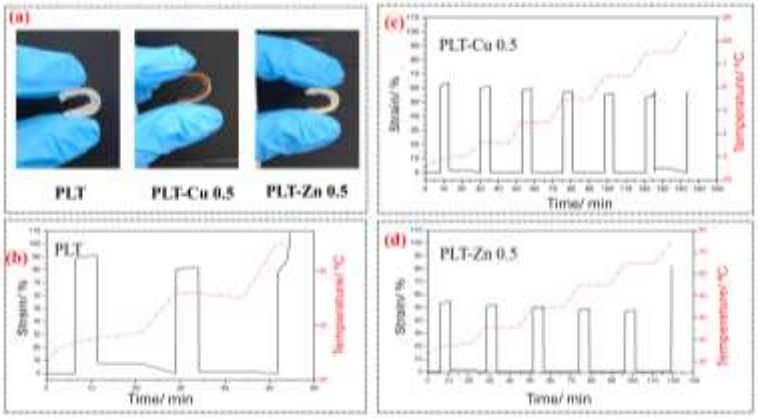

Figure 1: Polymer PLT and metallopolymer PLT-Cu-0.5 and PLT-Zn 0.5 (a), and their respective tensile creep TTS (b), (c), (d).

References

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Fundings: The authors would like to thank the São Paulo Research Foundation (grants: 23/14645-5, 24/00779-2, and 22/15211-6) for the financial support.

Keywords: *Metal-vitrimer, sustainable polymers, creep resistance.*