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## **Effects of incorporating Ni/Ni<sub>3</sub>C nanoparticles into cassava starch films**

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Resumo:

The development of sustainable polymeric films with sophisticated properties has attracted considerable attention due to the versatility of these materials and their potential application in replacing petrochemical-based polymers. In this context, the integration of metallic nanoparticles into plant-based matrices, such as starch, represent a perspective for obtaining these materials. In this study, we investigated the effects of incorporating Ni/Ni<sub>3</sub>C (core-shell) nanoparticles into the cassava starch matrix as a perspective for the development of magnetic films. The ferromagnetic nanoparticles, measuring 100 nm in size, were synthesized via the thermal decomposition method at 240°C for 3 hours. To fabricate the films, the nanoparticles were initially dispersed in ethyleneglycol using an ultrasonic processor, followed by the addition of cassava starch and 30 mL of distilled water, resulting in a nanoparticle mass fraction of 0.25% relative

to the starch mass. The solution was heated to a temperature of 60°C with constant stirring until gelatinization was attained. After this step, the gel was dispersed onto a silicone substrate using the casting technique, and the dispersion was placed in an oven at 50°C for 12 hours for film formation. The films were characterized by XRD, SEM, EDS, and AFM. Structural characterization by XRD showed characteristic diffraction peaks of Ni/Ni<sub>3</sub>C nanoparticles. Morphological characterizations showed the formation of films with an average thickness of 60 μm, with good dispersion of nanoparticles in the polymeric matrix. This distribution contributes to the magnetic response observed for the films upon the application of a magnetic field of 1T.