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ELECTRICAL CONDUCTIVITY OF BIODEGRADABLE COMPOSITES BASED ON ELECTRODEPOSITED Cu POWDERS AND LIGNOCELLULOSE

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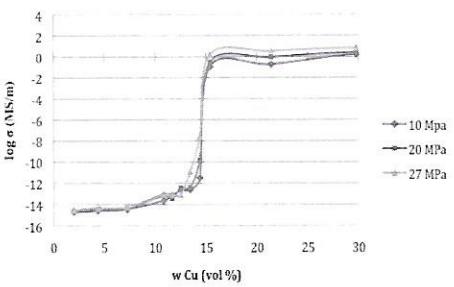
Composites based on natural polymers with conductive fillers have been gaining more and more significant roles in a variety of technological domains. These polymers with addition of electrochemically obtained conductive materials can be directly used as contemporary materials. This article is concerned with the preparation and characterization of the basic components: electrodeposited copper powder and lignocellulose (LC) as well as composite materials prepared by the compression molding of LC and galvanostatically obtained copper powder mixtures. Analysis of the most significant properties of individual components and prepared composites included quantitative structural analysis, morphological analysis, determination of density and porosity and measurements of electrical conductivity. Different investigation techniques including SEM, TGA, DSC, X-ray, FTIR, particle size distribution and conductivity measurements were used.

Results have shown that the powder has very high surface area and it has pronounced dendrite branching with well-developed primary and secondary dendrite arms. The conductivity measurements showed S-shaped dependency with percolation transition from non-conductive to conductive region, typical for such polymer composite materials. The electrical conductivity of the composites is < 10-15 MS/m, unless the metal content reaches the percolation threshold of 14.4% (v/v), beyond which the conductivity increases markedly by as much as 14 orders of magnitude. It was found that this transition occurs at lower volume fractions than stated in the literature, which can be due to the filler with high specific area. This research has undoubtedly shown that galvanostatically obtained copper powder plays significant role with its indented area in formation of greater number of contacts with smaller volume fractions. In this manner the value of percolation threshold is lowered.

Figure Left: Galvanostatically electrodeposited copper powder
Figure Right: Electrical conductivity of composites



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