

# POLITECHNIKA ŚLĄSKA W GLIWICACH

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## ROZPRAWA DOKTORSKA

*Kompozyty epoksydowe o ograniczonej wymywalności  
metali napętnione szkłem odpadowym*

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## ABSTRACT

The problem addressed in this dissertation concerns the area of managing and reusing materials that are currently waste in industrial processes. In the approach of the circular economy, if waste is already produced, it should be treated as secondary raw materials and used for re-production.

The value of products, materials, and resources should remain in circulation as long as possible, and waste generation should be minimized. The transition to the circular economy is a significant contribution to the EU's efforts towards developing a sustainable, low-carbon, resource-efficient, and competitive economy.

The cognitive goal of the study was to explore the possibility of using waste material, such as glass cullet, especially cathode ray tube (CRT) cullet, as a filler for polymer materials. This goal was achieved through a literature review, research on the use of glass cullet in polymer composites, and an analysis of their results. The literature review on the use of waste materials as fillers for polymer materials and the directions of using waste glass as fillers or aggregates in various technologies were presented in Chapter I of this study.

The main aim of the research was to prove the thesis of the possibility of developing such a composition and method of manufacturing polymer composites filled with glass dust from waste glass cullet, which is an effective and safe way to reduce metal emissions from hazardous waste glass. Additionally, the research aimed to prove the possibility of reducing the leachability of selected metals (Pb, Ba, Sr, Cd) into the environment from waste glass cullet by binding them in polymer-glass composites.

The conducted research and analysis of results (Chapters 3, 4, 5) allowed for the assessment of the usefulness of selected waste materials that emit heavy metals and their compounds as modifiers of the strength properties of epoxy resins. An attempt was made to evaluate the impact of such modifiers on the strength properties of composites filled with three types of powdered waste glass (float glass, car safety glass and CRT glass), produced by mixing the filler with ready-made resin and determination their ability to immobilize heavy metals contained in them by the polymer matrix.

The results, indicate that it is possible to use waste CRT glass as a filler for epoxy composites. Composites with good mechanical properties were obtained. The use of this type of epoxy composite is an effective way to immobilize lead contained in CRT glass. Additional modification with an aminosilane coupling agent allows for further reduction of metals leachability.