POLITECHNIKA ŚLĄSKA

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PRACA DOKTORSKA

Charakterystyka stopów magnezu modyfikowanych tlenkami metali ziem rzadkich

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The aim of the presented research was to investigate the possibility of replacing rare earth elements (cerium, lanthanum, neodymium) with their oxides (CeO_2, La_2O_3, Nd_2O_3) in order to improve the properties of magnesium alloys while reducing production costs. The study utilized microstructure analysis, wear resistance, corrosion resistance tests, XRD analysis, and transmission electron microscopy.

Microstructural studies of AZ31 and AZ91 alloys, modified with oxides at three selected temperatures, revealed the influence of temperature on the morphology and type of precipitates. The use of rare earth oxides as substitutes for metallic elements significantly affected the tribological properties, including wear resistance and the coefficient of friction. EDS analyses confirmed the diffusion of rare earth elements into the material's matrix with limited oxygen diffusion.

The identified phases included Mg, $Mg_{17}Al_{12}$, and various intermetallic compounds, such as Al_4Ce, $Al_8Ce_1Mn_4$, and Nd_5Mg_{41}, depending on the element and temperature. Corrosion tests showed that the addition of cerium to the AZ31 alloy at 700°C significantly improved its corrosion resistance, which is particularly important for the long-term use of materials in harsh environmental conditions.

In conclusion, the research confirmed that using rare earth oxides is an effective strategy for improving the mechanical and corrosion properties of the material while simultaneously reducing costs, particularly in the case of CeO_2. The results open up new possibilities for the application of rare earth oxides in various technological applications.