Chapter

Introductory Chapter: Magnesium Alloys

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1. Introduction

Non-ferrous metal alloys, including magnesium alloys, are the subject of research in numerous research and scientific centres and universities, both in Poland and abroad, as well as at major manufacturers of the automotive, mechanical engineering, shipbuilding, aviation, chemical, energy, electronics, textile and even nuclear industries. The combination of low density of magnesium alloys (1.5–1.8 g/cm^3), the best among all currently known construction materials and high strength in relation to low weight, as well as the possibility of use on machine parts operating at temperatures up to 300°C, make these alloys widely used in various industries.

Demand for magnesium and its alloys continues to grow, as they have the potential to be used in many new areas of life, as well as in expanding use in existing applications. The growth of the electronic devices market related to the growing demand for ever lighter vehicles and hand tools has repeatedly increased the trade demand for castings from Mg alloys and the efforts of manufacturers in the area of their research and development [1–3]. High specific strength (the ratio of tensile strength and modulus of elasticity to specific weight), the ability to damp vibrations and low resistance to corrosion, allows the use of castings from Mg alloys as an alternative solution to Al alloys, as well as for parts made of plastics and composite materials.

In order to reduce the weight of products while maintaining the assumed strength and stiffness, light metal alloys are most often used in the transport industry or machine construction. As a result, products made of light metals reduce the negative impact of human activity on the natural environment, while ensuring their competitiveness [4]. Industrial Mg alloys used in aviation (WE43, MSR, RZ5) are characterized by a very low elongation compared to alloys intended for use as parts in the automotive industry. Seventy percent of magnesium alloys production is used in the automotive industry, and the remaining thirty percent mainly in the aerospace and electronics industries. For example, Audi (automotive) company, in order to reduce the weight of vehicles, produces five-speed gears made of magnesium alloy AZ91HP (Cu 0.016%, Mn 0.17%, Zn 0.72%, Si 0.03%, Fe 0.002%, Al 9.45%, Ni 0.025%). Vehicles in which parts made of light metal alloys are used burn less fuel, which in turn reduces the consumption of fossil fuels and the emission of pollutants into the atmosphere [5, 6].

In addition, magnesium alloys have found applications in aviation (helicopter gear housings, A320, F16 aircraft components), automotive industry (Rolls Royce and BMW engines, wheel rims, city bus handrails), electronics industry (Nikon

SLR camera body), gardening industry (Nikon body crankcase in Husqvarna petrol mowers), recreation (elements of bicycle construction), construction (window structures, bolts, handles) or medicine (implants, e.g. Magnezix) [5, 7]. Currently, implants made of magnesium alloys (Magnezix®) are implanted in patients with wrist fractures. The metal screw after absorption is replaced by bone tissue. Screws made of Magnezix® are already being implanted in patients. On the basis of observations, wound healing after 6 weeks and gas evolution as a result of screw degradation were observed. No postoperative complications were reported. Injuries to the osteoarticular system, as well as diseases of the musculoskeletal system, including the continuous increase in the incidence of bone cancer, are the main and most common threat to the health of modern society. Hence the growing demand for new biomaterials, such as resorbable magnesium alloys.

The monograph "Magnesium Alloys - Processing, Potential, Applications" collects the latest processing methods as well as potential and newly developed areas of application of magnesium alloys. Due to the continuous improvement and development of the use of magnesium alloys in the automotive industry, the book contains content regarding both application possibilities and an improved version of the method of their production. Recent reports on the use of magnesium alloys as thermoelectric elements have also been presented. Details on the applications of dissolvable magnesium alloys are presented. In medicine, Mg and its alloys have been considered for two decades as a degradable implant material. The concept and progress in determining key properties for implantology applications are discussed.

The growing trends in the production of magnesium alloys indicate an increased need for their use in the broadly understood construction industry, therefore it is expected that these alloys will become one of the most frequently used construction materials of our century, which is the basis for maintaining and developing a high pace of research on the problem of light alloys.

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