Magnesium Alloys With High Ignition Temperature

Klara Hosova, Jiri Kubasek, Dalibor Vojtech

University of chemistry and technology Prague, Technicka 5, 166 28 Prague 6,
E-mail: hosovak@vscht.cz

High demands for weight reduction and improved fuel efficiency has led to a growing interest in magnesium alloys. With their low density and high strength-to-weight ratio, magnesium alloys have the potential to significantly reduce the weight of vehicles, resulting in lower fuel consumption and reduced emissions, aligning with the need for environmentally-friendly transportation solutions. Nevertheless, magnesium alloys come with their own set of challenges. They exhibit high reactivity with oxygen, poor corrosion resistance, and a notable flammability risk. These drawbacks were so significant that the use of magnesium alloys in aircraft cabins was banned for safety reasons until 2015. The lifting of this ban by the Federal Aviation Administration (FAA) has sparked increased interest in the application of magnesium alloys in the aviation industry.

In this study, we focused on Mg-Y based alloys containing further alloying elements such as Ca and Zn. The addition of these elements resulted in improved mechanical properties and ignition resistance of prepared alloys. Specifically, the alloying elements contributed to the formation of resistant oxide layers, leading to higher ignition temperatures (Y and Ca), enhanced strength (Y and Zn), and reduced materials costs (Ca and Zn). The alloys were prepared by melting the constituents in an induction furnace and casting them into brass mold. The microstructures of the prepared samples revealed a solid solution of alloying elements in magnesium, supporting increased resistance to ignition. Furthermore, the equilibrium phases corresponding to the specific chemical composition of each alloy, which are responsible for the strengthening of the materials, were analyzed. This project was supported by GACR No. 22-22248S and by specific university research – project No. A1_FCHT_2023_009.