Magnesium and its alloys are the lightest structural materials. They exhibit a high specific strength, which is higher than that of most other metals. However, their formability is worse than that of comparable aluminium alloys and the challenges regarding the extraction is a serious issue for a broad industrial application. In order to reach high surface quality of the profiles only low extrusion speeds are possible when conventional magnesium alloys are used. Special efforts are required to enable the application of high strength extrusion profile processed at high extrusion speeds. The development of novel alloys was focused on compositional optimization and adapted heat treatment procedures.

Results and outlook
The first approach was an alloy with a very high content of aluminium, with minor additions of Calcium. Due to the formation of homogeneously distributed strengthening phases within the material prior to the extrusion process a fine-grained microstructure was achieved with re-

High performance magnesium alloy with excellent material strength and advanced productivity
The efficient and competitive manufacturing of extruded profiles made of high strength magnesium poses a special challenge to the process chain. Besides measures regarding the processing equipment, striving for the direct usage of a cast ingot at extrusion without any intermediate machining preparation, the design of a suitable alloy system is most important part. The concept of a lean alloy showed the feasibility of high strength as well as high processing velocity.

Amoree
Aluminium and magnesium processing optimisation with special respect to resource and energy efficiency
Programme: COMET – Competence Centers for Excellent Technologies
Programme line: K-Projects
sulted in the desired high strength. Unfortunately, the extrusion rate was too low. Hence, the proposed alloy composition is less suitable for industrial extrusion. On the other hand, an application of alternative bulk metal forming processes might be useful.

Investigations on a lean alloy system with aluminium, calcium und manganese as main alloying elements showed very good results with the ability to achieve the goals of this project. Starting at an alloy composition taken from literature a rectangular shaped hollow profile with excellent surface quality was extruded with high speed up to 14.5 m/min, figure 1.

![Magnesium profile extruded with extrusion speed of 14.5 m/min](image)

The following systematic modifications based on thermodynamic simulations regarding alloy composition and heat treatment parameters resulted in an artificially aged alloy with excellent mechanical properties. This alloy strategy was formulated in a patent application (Nr. A 51016/2016).