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## Biodegradable magnesium implant materials – state of the art

Corrosion behavior of Magnesium and its alloys are normally crucial for nu¬merous applications and hinder often its use. But this disadvantage turns into a tremendous benefit in the area of degradable implants. Here, Magnesium alloys gained interest as biocompatible, degradable im¬plant materials. Magnesium is an essential element for the human body and therefore the body owns a regulating system that balances intake and excretion of Magnesium. Therefore a toxic accumulation can be avoi¬ded. Additionally Magnesium alloys are showing better mechanical pro-perties compared to polymers, titanium, stainless steels or cobalt-chromium alloys as their strength and stiffness is much closer to human bone. Besides applications in the musculo-skeletal system they are also suitable as stent materials in the cardiovascular system. And again they offer advantages compared to other stent materials like polymers, stainless steels and titanium. One advantage of Magnesium based implant materials is that it can be resorbed by the human body after a given time. This is of benefit e.g. for stents as well as for implants that are used in children traumatology. In the first case there is still a risk of restenosis which requires now a coronary bypass surgery. In the case of bone implants for children a removal of permanent implants would be necessary in any case due to still growing bone of children. However, the requirements for stents or bone implants are different. To adjust processability as well as properties alloying and process optimization are necessary. We will report the state of the art in the area of rare earth containing Magnesium alloys and the developments at the Magnesium Innovation Centre.

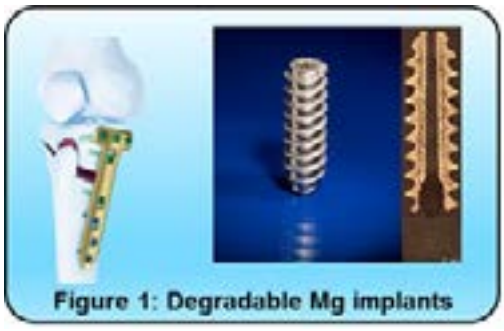

Figure 1: Degradable Mg implants

### Recent Publications


1. N. Hort, Y. Huang, D. Fechner, M. Störmer, C. Blawert, F. Witte, C. Vogt, H. Drücker, R. Willumeit, K. U. Kainer, F. Feyerabend, Magnesium alloys as implant materials - Principles of property design for Mg-RE alloys, Acta Biomaterialia 6 (2010) 1714-1725
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5. O. Charyeva, F. Feyerabend, R. Willumeit, D. Zukowski, C. Gasqueres, G. Szakács, N. A. Agha, N. Hort, F. Gensch, F. Cecchinato, R. Jimbo, A. Wennerberg, K. S. Lips, In Vitro Resorption of Magnesium Materials and its Effect on Surface and Surrounding Environment, MOJ Toxicol 2015, 1(1): 00004.
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8. M. Bartosch, H. Peters, A. Koerner, B. Schmitt, F. Berger, N. Hort, F. Witte, New methods for in vivo degradation testing of future stent materials, Materials and Corrosion (2017) 1-11

## Biography

Karl Ulrich Kainer is the director of the Magnesium Innovation Centre (MagIC) at the Helmholtz Centre Geesthacht. The main focus of the research in MagIC, headed by Prof. Karl Ulrich Kainer, is the development of magnesium-based materials for diverse applications, for example in the transport and medical sectors. Special emphasis is placed on alloy development and on the optimization of existing and new processing technologies. Scientific fundamental research and application-oriented investigations are necessary in order to produce magnesium materials with the optimum spectrum of properties for specific service applications. MagIC has established capabilities and the appropriate equipment for this purpose.

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**Notes:**