# FE Simulation of the Expansion of a WE43 Magnesium Alloy Stent in a Representative Blood Vessel

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## ABSTRACT

In recent years, there has been growing interest in the application of magnesium alloy materials to the manufacture of cardiovascular stents which are used expand blood vessels which have narrowed due to disease [1]. Conventional permanent stents, manufactured from stainless steel or titanium alloys, have seen widespread use but have recently been recognised as being limited by stent thrombosis and in-stent restenosis. Magnesium alloy stents, which naturally corrode and are absorbed in the body over time, have the potential to overcome many of the problems associated with conventional stent technology [2]. It is imperative, however, to fully understand the material deformation behaviour during the deployment of magnesium alloy stents in order to avoid problems such as material fracture during the expansion process. There are currently very few studies on the deformation mechanisms of magnesium alloy tubes and stents. It is particularly important to accurately predict fracture during the expansion process as there is significant potential to damage to the blood vessel and cause increased patient suffering. Thus, in this study, the material fracture of magnesium alloy stents has been evaluated and predicted using a combination of finite element analysis (FEA) and a ductile fracture criterion. Tensile tests and hydraulic bulge tests on the magnesium alloy stent material were used to determine the parameters for the ductile fracture criterion. The ductile fracture criterion is then used to predict failure of a magnesium alloy stent when deployed in a representative diseased blood vessel.

## REFERENCES

[1] http://www.nims.go.jp/jpn/news/press/pdf/press136.pdf , (2006)(in Japanese).

[2] E. Galvin, M. M. Morshed, C. Cummins, S. Daniels, C. Lally and B. MacDonald, “Surface Modification of Absorbable Magnesium Stents by Reactive Ion Etching”, Plasma Chem Plasma Process, **33**, 1137–1152 (2013).