

SELECTIVE LASER SINTERING OF MAGNESIUM POWDER FOR FABRICATION OF POROUS STRUCTURES

Ng Chi Chung

The Advanced Manufacturing Technology Research Centre, Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, China

e-mail: eddyncc1@yahoo.com.hk

Porous biomaterials, has drawn much attention recently, because of their utility in advanced practical applications in biomedical industry such as bioactive implants and tissue scaffolds. Among different engineering methods for the fabrication of porous structure compacts for biological implants, the direct metal laser sintering (DMLS) technique is of particular interest due to its flexibility in materials, capability of fabricating 3D geometrically complex shapes and, most importantly, controllability of internal porous structures using appropriate processing conditions. In past decades, considerable research effort has been reported in the area of direct metal laser sintering. However, rarely work has previously been found on the laser sintering of magnesium powder, which may mainly due to the restriction of its highly flammable characteristic in ambient environment under laser irradiation. Magnesium possess of excellent strength to weight ratio, good mechanical properties and high degree of biocompatibility, making it become a potential candidate for the fabrication of biological implants. The novelty of the present research lies in the fabrication of porous structures by laser sintering of magnesium powder using a continuous wave (CW) Nd:YAG laser. The laser sintering of single tracks and single layers of magnesium powder were carried out for demonstrating the process feasibility and for examining the influences of two main processing parameters in terms of laser power and scan speed on the microstructural characteristics and mechanical properties of the final porous structures. The experimental results demonstrated that porous structures of magnesium compacts have been successfully fabricated by selective laser sintering technique. The results also give sufficient and reliable information about the microstructural evolution of magnesium powder under a continuous wave (CW) Nd:YAG laser, which would facilitate the fabrication and controllability of porous structures by deliberating the associated effect of different processing parameters, whilst achieving superior quality for the laser sintered parts.