Martin Mapley et al., J Material Sci Eng 2019, Volume 8
DOI: 10.4172/2169-0022-C2-129

3rd International Conference on
3D Printing Technology and Innovations
March 25-26, 2019 | Rome, Italy

Bonded NdFeB magnets produced by selective laser sintering

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The production of complex-shaped bonded NdFeB (neodymium-iron-boron) magnets is a key element in the development of compact and efficient electromechanical devices. Due to constraints imposed by current manufacturing methods, geometrically complex magnets are high in cost and require long lead times. The use of additive manufacturing techniques for low volume production of complex geometries from a wide range of materials has been shown to dramatically decrease product cost and lead times. This work describes the production and characterisation of net-shaped bonded NdFeB magnets using selective laser sintering (SLS) from mechanically mixed powders. Net-shaped magnets, cuboids for geometrical measurements and cylinders for magnetic measurements, were produced using magnetic powders with both flake and spherical particle morphologies mixed with polyamide-12. The powder loading fractions, which were based upon the ratio of the bulk density to the theoretical density of the individual magnetic powders, were 38% and 56%/volume for the flake and spherical powders respectively. The mixed feedstock was processed using an experimental SLS machine equipped with a mechanically tracked 15 W solid state laser emitting radiation at a wavelength of 445 nm. The magnets were shown experimentally to possess a high level of geometrical accuracy (less than 0.15 mm deviation from model data) with magnetic properties comparable to permanent magnets produced using other additive manufacturing methods (residual induction of 284 and 357 mT, intrinsic coercivity of 661 and 735 kA/m for flake and spherical powders respectively). This work has demonstrated the feasibility of producing bonded magnets using SLS, allowing the possibility for the rapid, cost-effective production of geometrically complex magnets.

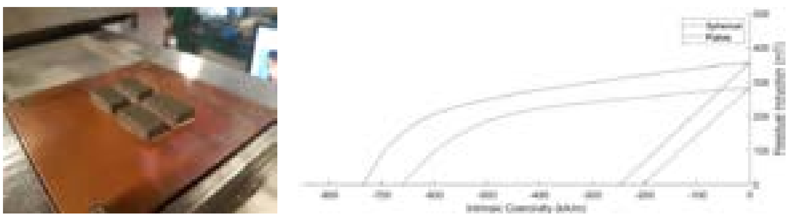

Figure 1: Results showing a) bonded NdFeB cuboids on the build piston directly after processing and b) demagnetisation curves for the bonded magnets produced using flakes and spherical particles

Recent Publication:

1. T Masuzawa, M Osa and M Mapley (2017) "Motor and Suspension Design," Mechanical Circulatory and Respiratory Support, 1st Ed, Oxford, UK, Elsevier, ISBN: 9780128104927.

Biography

Martin Mapley is currently undertaking his PhD with Griffith University, Queensland, Australia. He is also a Researcher at the Innovative Cardiovascular Engineering and Technology Laboratory at the Prince Charles Hospital, Queensland, Australia.

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