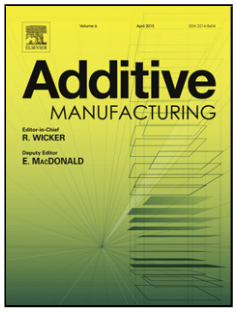

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Electrical resistivity of additively manufactured AlSi10Mg for use in electric motors

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Abstract

Additive manufacturing (AM) opens up a design freedom beyond the limits of traditional manufacturing techniques. Electrical windings created through AM could lead to more powerful and compact electric motors, but only if the electrical properties of the AM printed part can be shown to be similar to conventionally manufactured systems. Until now, no study has reported on the suitability of AM parts for electrical applications as there are few appropriate materials available to AM for this purpose. AlSi10Mg is a relatively good electrical conductor that does not have the same reported issues associated with processing pure aluminium or copper via selective laser melting (SLM). Here, experiments were conducted to test the effects of geometry and heat treatments on the resistivity of AlSi10Mg processed by SLM. It was found that post heat treatments resulted in a resistivity that was 33% lower than the as-built material. The heat treatment also eliminated variance in the resistivity of as-built parts due to initial build orientation. By conducting these tests, it was found that, with this material, there is no penalty in terms of higher resistivity for using AM in electrical applications, thus allowing more design freedom in future electrical applications.

Keywords:

- electrical resistivity;
- electrical conductivity;
- selective laser melting;
- additive manufacturing;
- 3D printing;
- aluminum alloy;

Highlights:

- 3D printed AlSi10Mg can be used in electrical applications once heat treated
- Electrical resistivity values once heat treated are comparable to cast alloy values
- Resistivity of as-built AlSi10Mg increases by 27% depending on build orientation
- Heat treatment can reduce as-built resistivity by 33%

Graphical abstract: