The experimental results on the flexible characteristics of the fabricated inductors are discussed. As an application, a thin and flexible DC-DC Boost Converter (2 W/5 V/400 mA) is designed, in which the flexible inductor is embedded. The flexible characteristics of embedded inductors composed of Fe-Si-Al powder composite films are presented in this paper along with the experimental results of flexible-boarded low power DC-DC boost converter using this inductor. Therefore, the Fe-Si-Al powder composite films can be a solution. Of late, low power electronic systems are becoming increasingly compact; consequently, the sizes of the smaller passive components (magnetic components, capacitors) also are becoming critical. To enable compact magnet design, the magnetic materials of magnetic components should have a higher magnetic saturation and permeability at high frequencies and flexible characteristics. The flexible characteristics of embedded inductors composed of Fe-Si-Al powder composite films are discussed in this paper. Therefore, the Fe-Si-Al powder composite films can be a solution. Of late, low power electronic systems are becoming increasingly compact; consequently, the sizes of the smaller passive components (magnetic components, capacitors) also are becoming critical. To enable compact magnet design, the magnetic materials of magnetic components should have a higher magnetic saturation and permeability at high frequencies and flexible characteristics. Therefore, the Fe-Si-Al powder composite films can be a solution.

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Introduction

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- Therefore, the Fe-Si-Al powder composite films can be a solution.
- The flexible characteristics of embedded inductors composed of Fe-Si-Al powder composite films are discussed in this paper along with the experimental results of flexible-boarded low power DC-DC boost converter using this inductor.
- As an application, a thin and flexible DC-DC Boost Converter (2 W/5 V/400 mA) is designed, in which the flexible inductor is embedded.
- The experimental results on the flexible characteristics of the fabricated inductors are discussed.

Dimensions of the copper coils and board

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>0.28</td>
<td>mm</td>
</tr>
<tr>
<td>Height</td>
<td>0.07</td>
<td>mm</td>
</tr>
<tr>
<td>Gap for each trace</td>
<td>0.1</td>
<td>mm</td>
</tr>
<tr>
<td>Number of turns</td>
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<td>-</td>
</tr>
<tr>
<td>Inductor thickness</td>
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<td>mm</td>
</tr>
<tr>
<td>Board thickness</td>
<td>0.16</td>
<td>mm</td>
</tr>
</tbody>
</table>

Flexible Fe-Si-Al powder composite film inductor and DC-DC Boost Converter

- Initial inductance and Maximum Q-factor is 4 μH, 12.5
- The saturation value and DC resistance is 450 Ω, 0.72 Ω
- When the flexible inductor is folded (to 0°, 45°, 90°, and >90°), the initial inductance, Q-factor, and the saturation characteristics are almost similar.

Converter Prototype and The result of experiment

- The fabricated inductor was applied to a DC-DC Boost. The flexibility of the flexible inductor was verified by folding it; it was established that the flexible inductor (to 0°, 45°, 90°, and >90°) exhibited low values up to 3 MHz.

Conclusion

- The fabrication of an embedded flexible inductor using Fe-Si-Al metal alloy powder films and its application in a flexible DC-DC Boost converter circuit board is described.
- The fabricated inductor exhibited advantageous characteristics like thinness, flexibility, and high permeability.
- To verify the electrical characteristics of the fabricated inductor, simulation was carried using Maxwell 3D tool and measurements were carried out by folding the fabricated flexible inductor (to 0°, 45°, 90°, and above 90°).
- The measurement results were in agreement with the simulation results.
- The flexible inductor was applied to a DC-DC Boost. The fabricated DC-DC Boost converter recorded a maximum efficiency of 84% for a 100 mA load current and 0° of flexible inductor angle.
- The flexibility of the flexible inductor was verified by folding it; it was established that the flexible inductor performed its role suitably in the low power DC-DC converter.