



FeSi-based multilayered thin films for HF applications

C. Serletis¹, G. Giannopoulos¹, H. Kijima², M. Yamaguchi³, G. Ababei⁴, N. Lupu⁴, G. Loizos¹ and D. Niarchos^{1,*}

¹Institute of Nanoscience and Nanotechnology, NCSR 'Demokritos', Athens, Greece

²Frontier Research Institute for Interdisciplinary Sciences (FRIS), Tohoku University, Sendai, Japan

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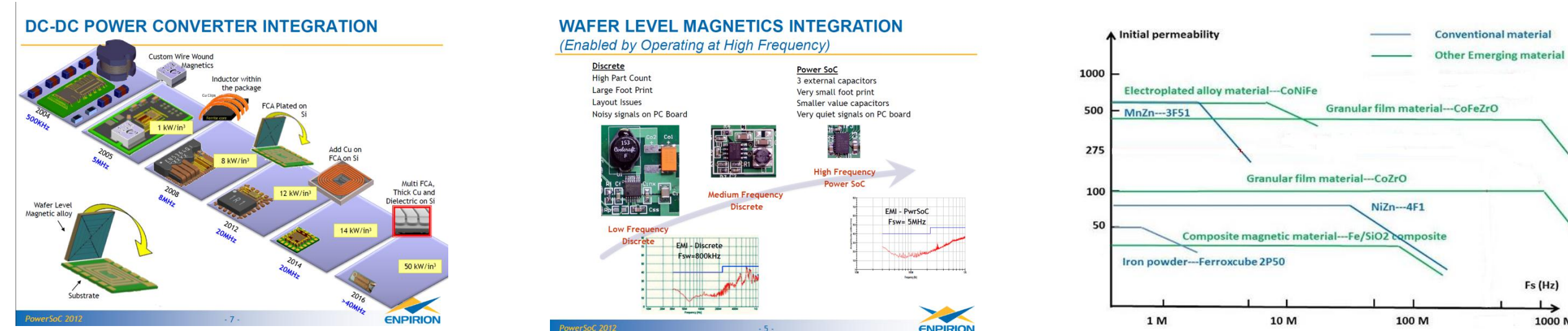
⁴National Institute of R&D for Technical Physics, Iasi, Romania



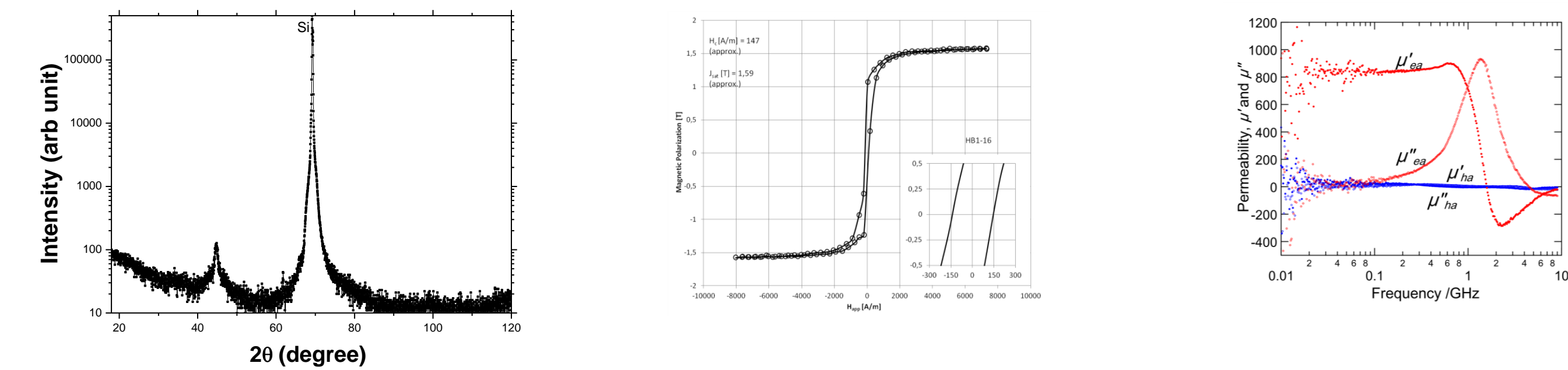
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The challenge



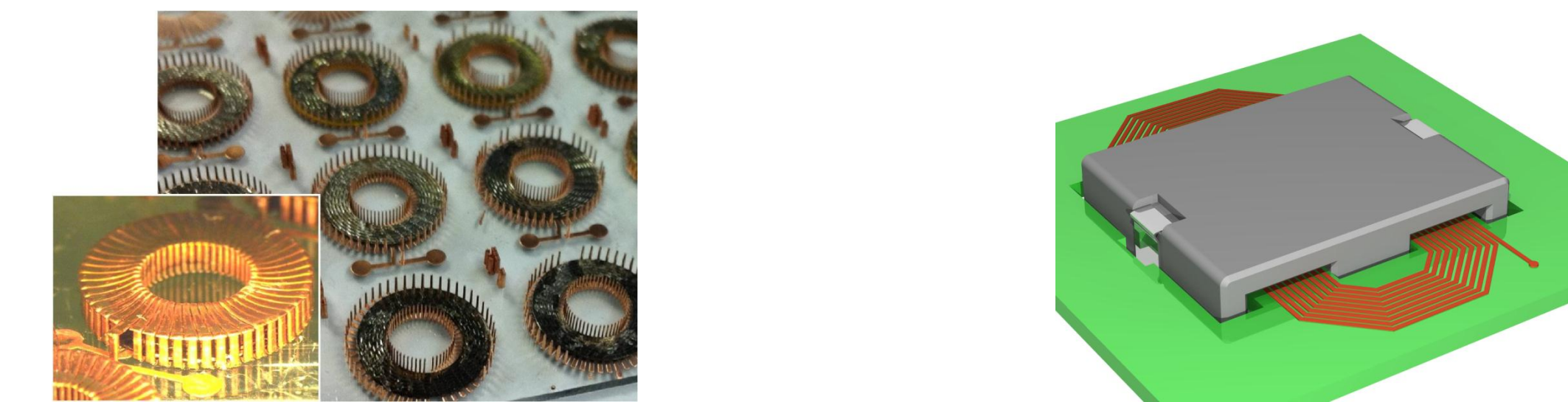
Our results



Our approach



The implications and future work





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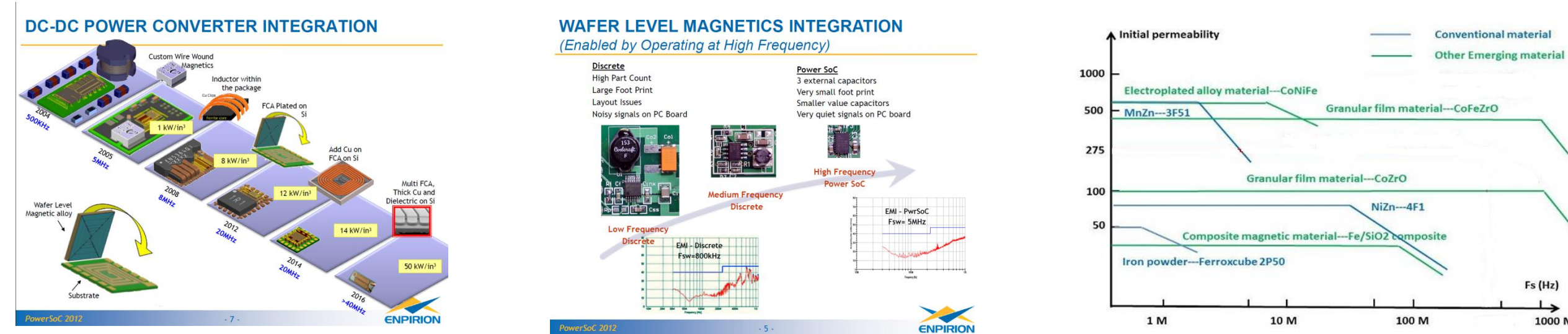
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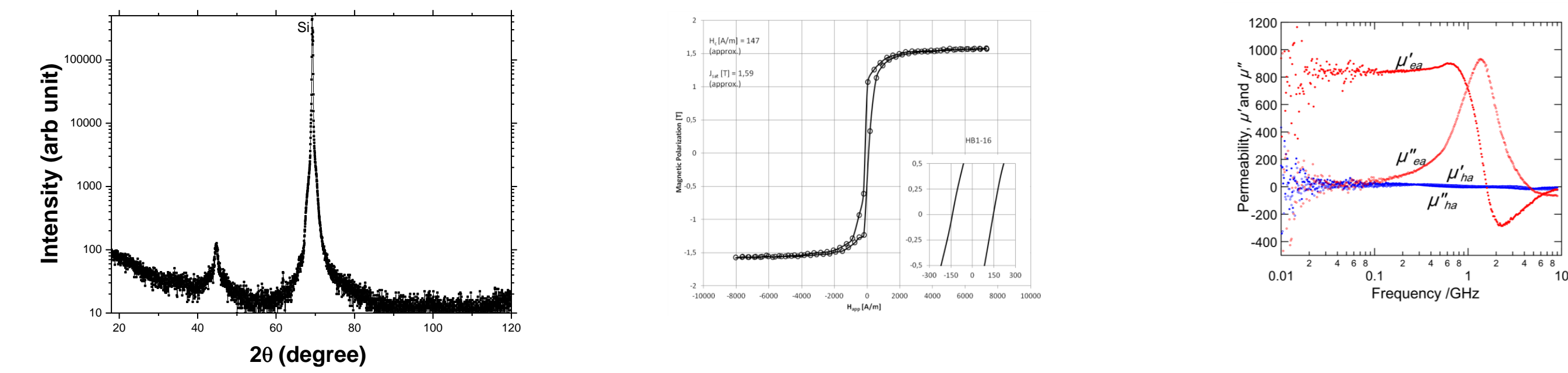
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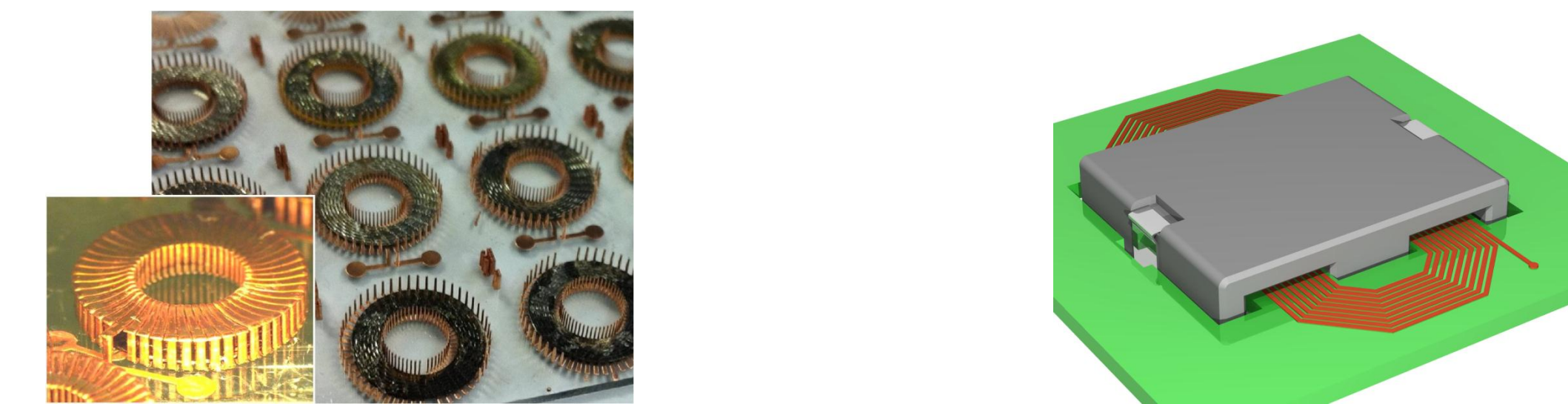
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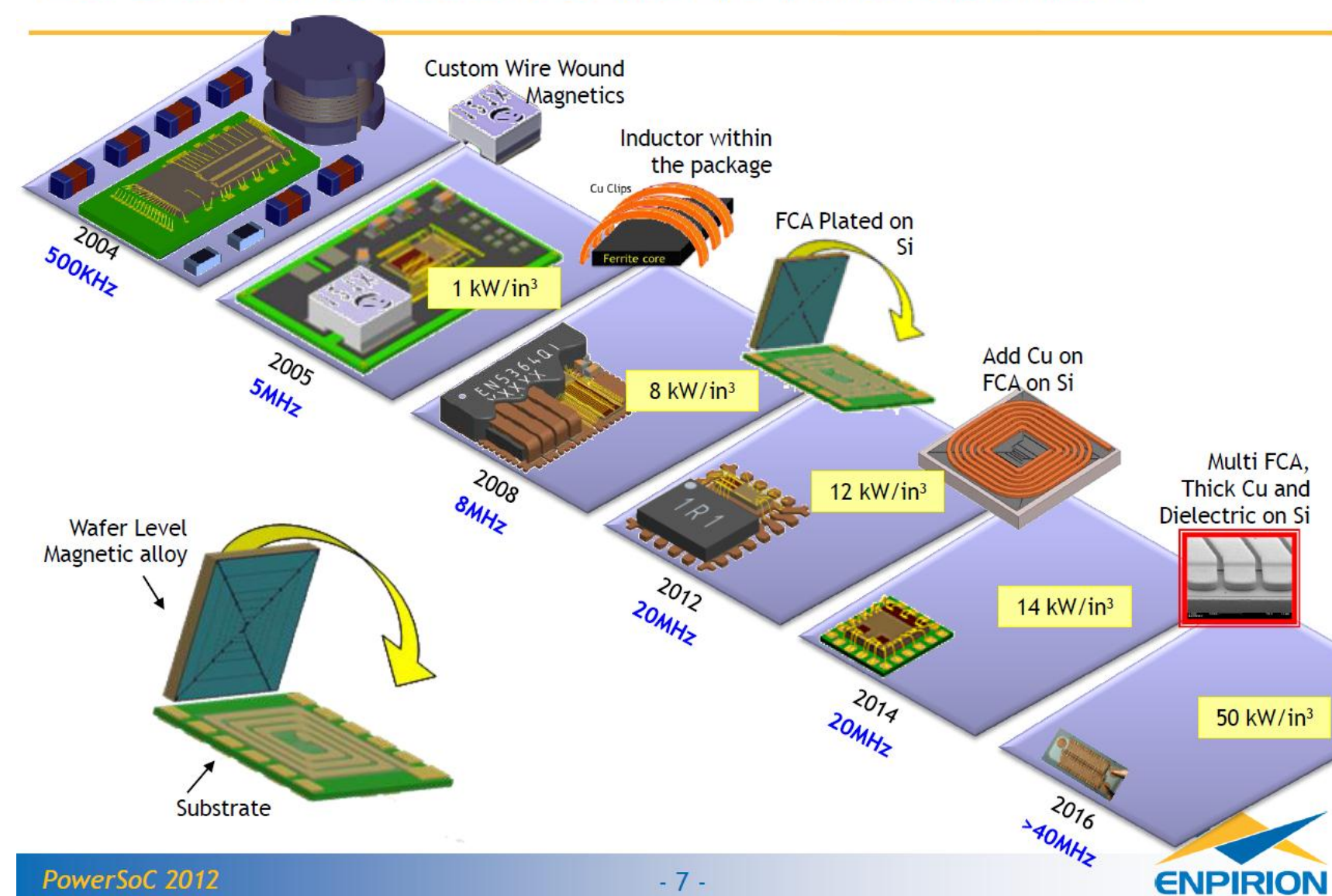


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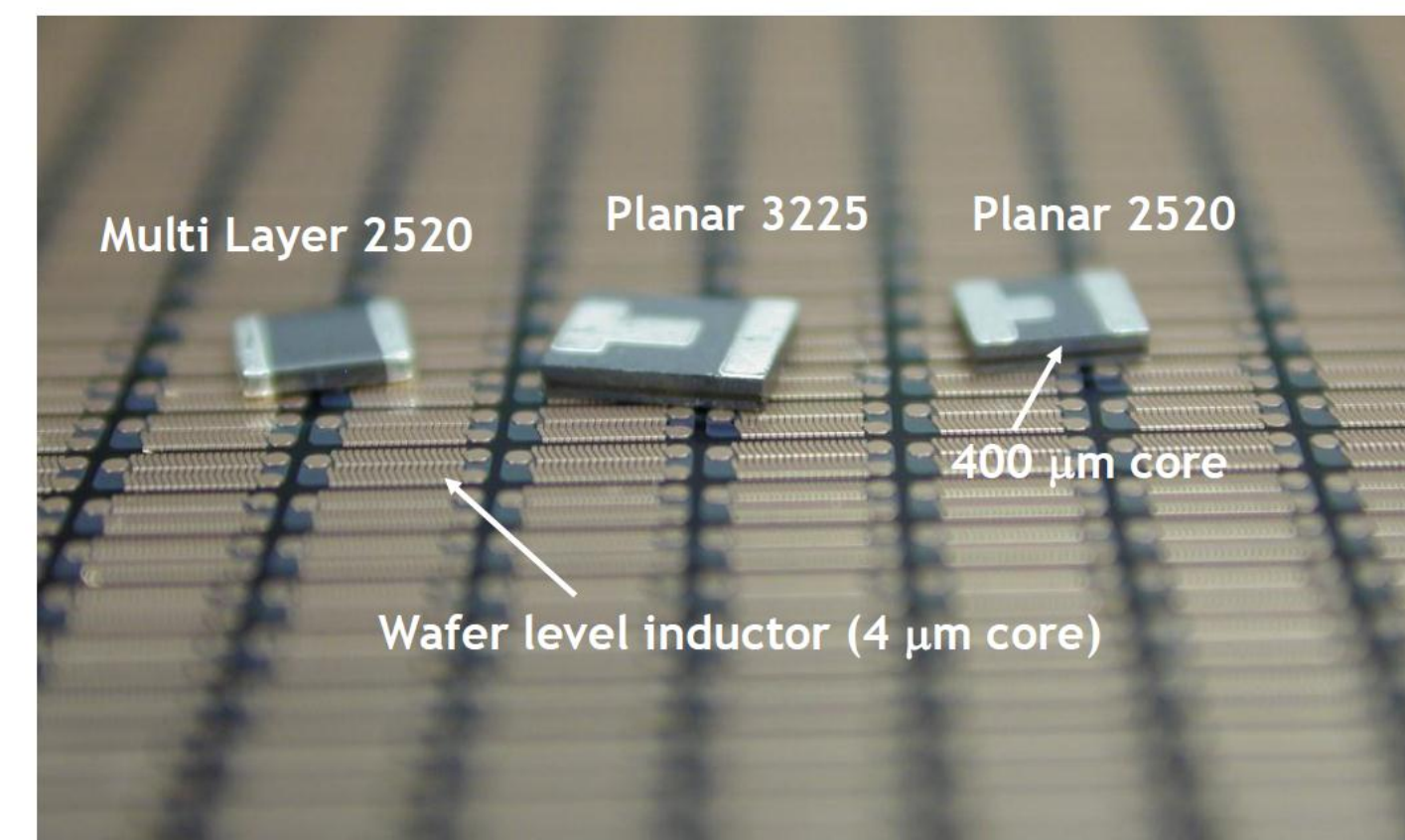
DC-DC POWER CONVERTER INTEGRATION



Switch-mode power electronics technology has enabled the growth of the hi-tech electronics industry due to its ability to efficiently process and convert electrical power in a small volume.

WAFER LEVEL MAGNETICS

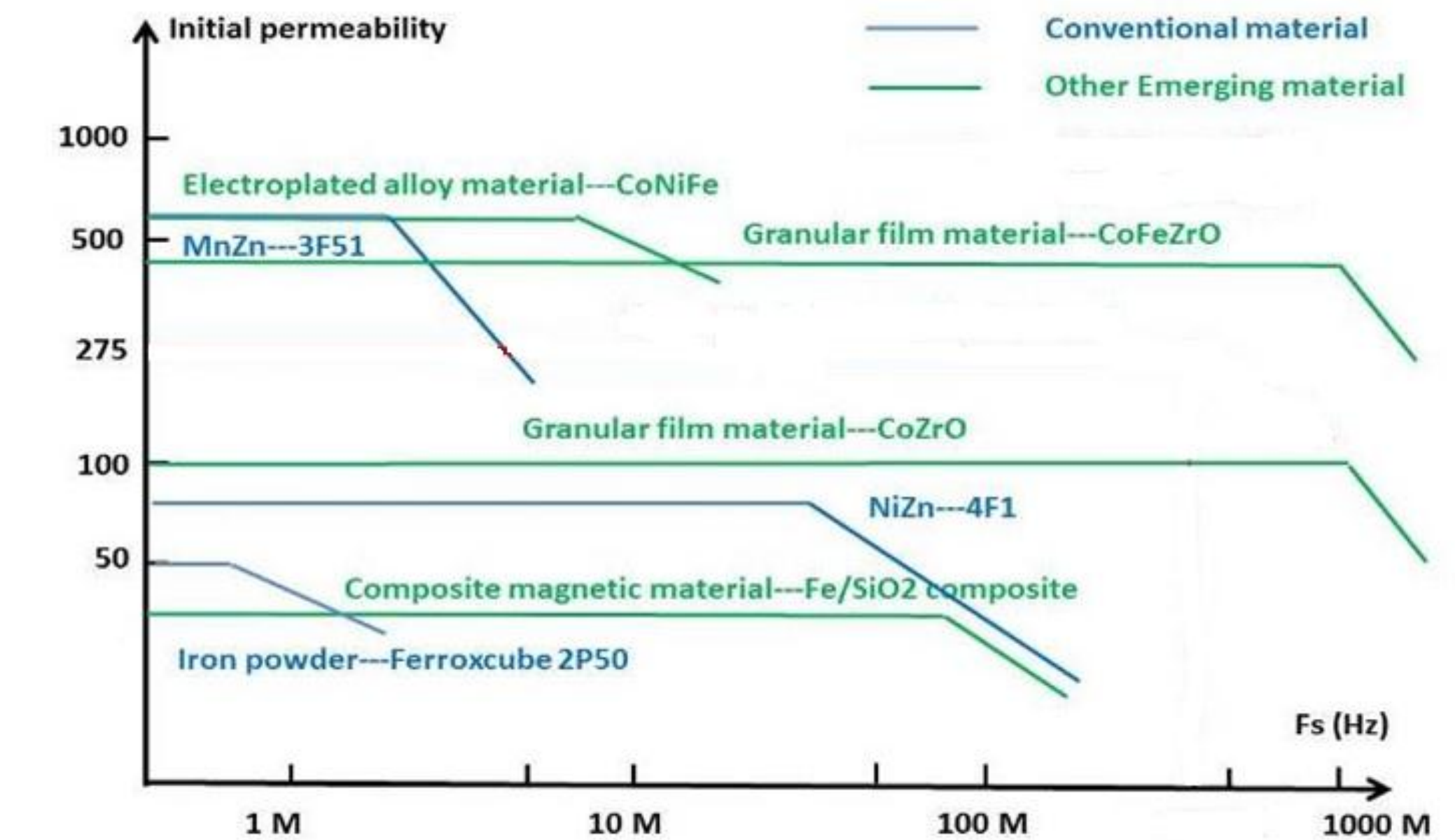
(Going from 3D to 2D)



FCA film magnetic core is ~100 times thinner than discrete inductor core

Wafer Level Magnetics is a concept based on nano-laminated magnetic thin films for use as chip inductors in DC-DC power converters.

This objective takes magnetic components from their 3-D discrete shape to a planar 2-D form that can be deposited on top of CMOS wafers.



Industry demands for higher efficiency, smaller size and lower noise at the lowest cost. New materials are needed for applications above 100MHz.

*Left and middle picture courtesy of Enpirion Inc.



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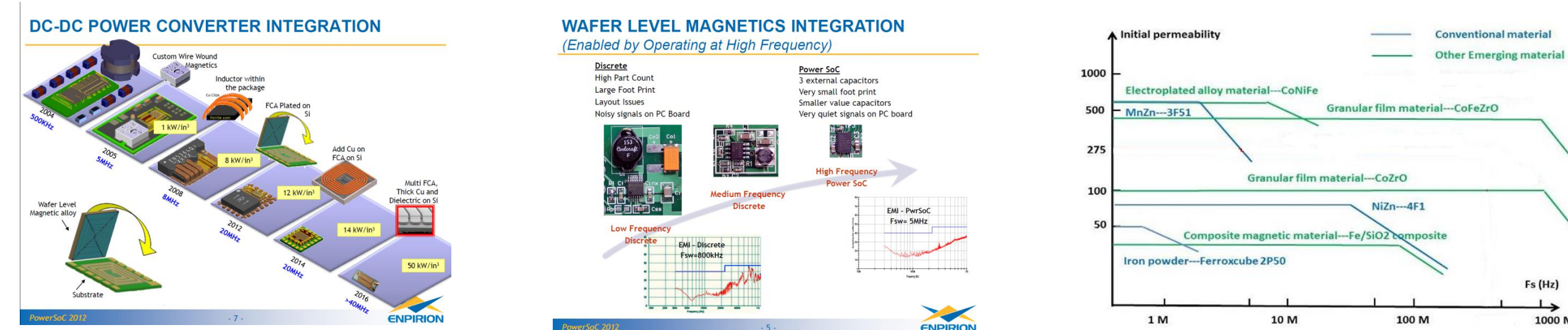
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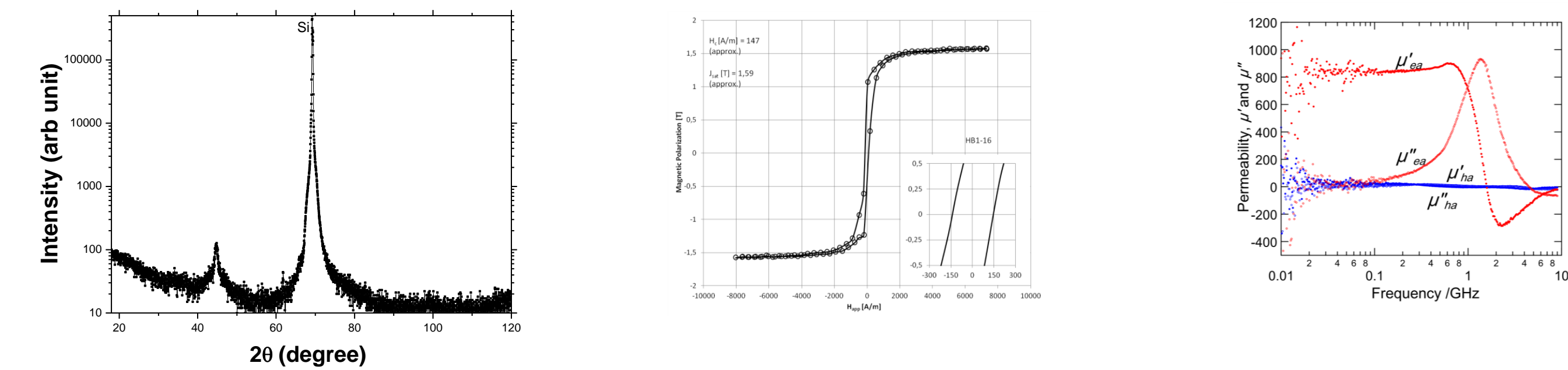
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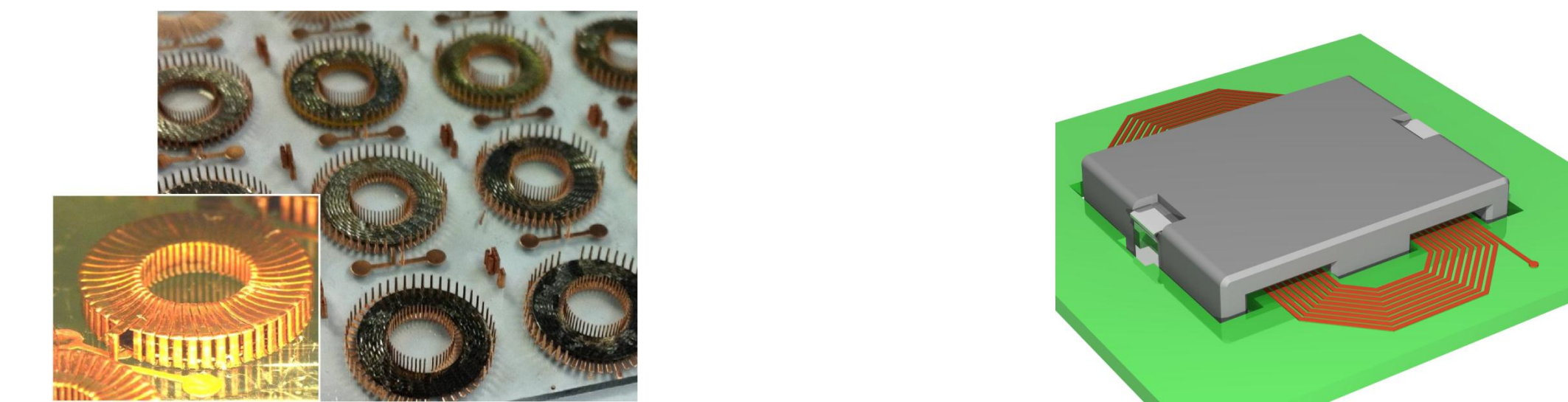
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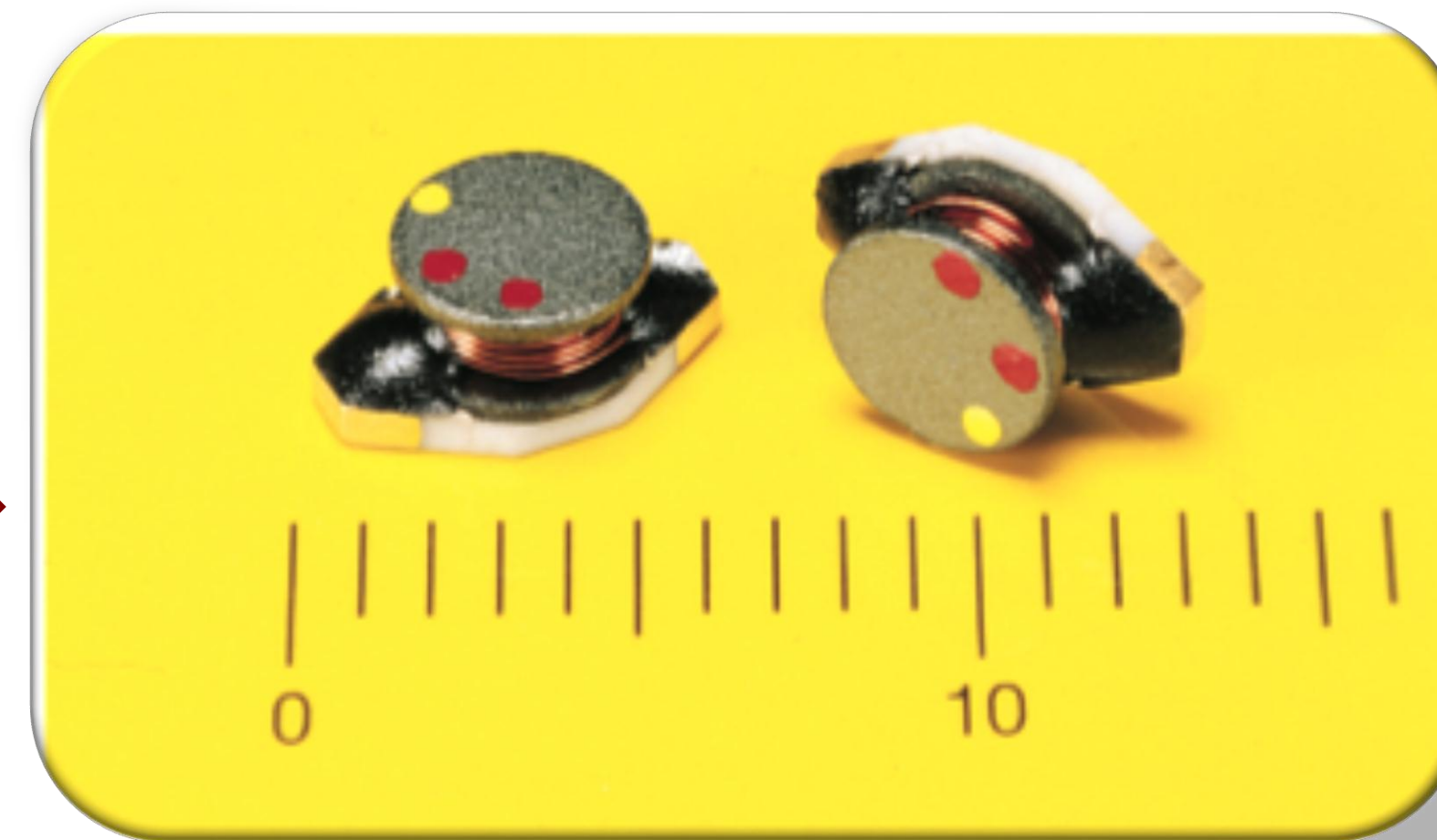
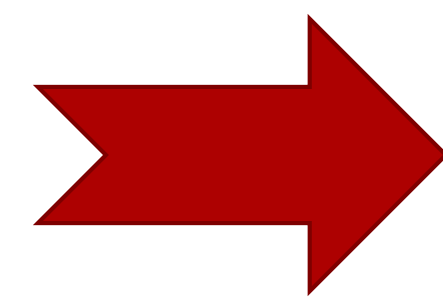
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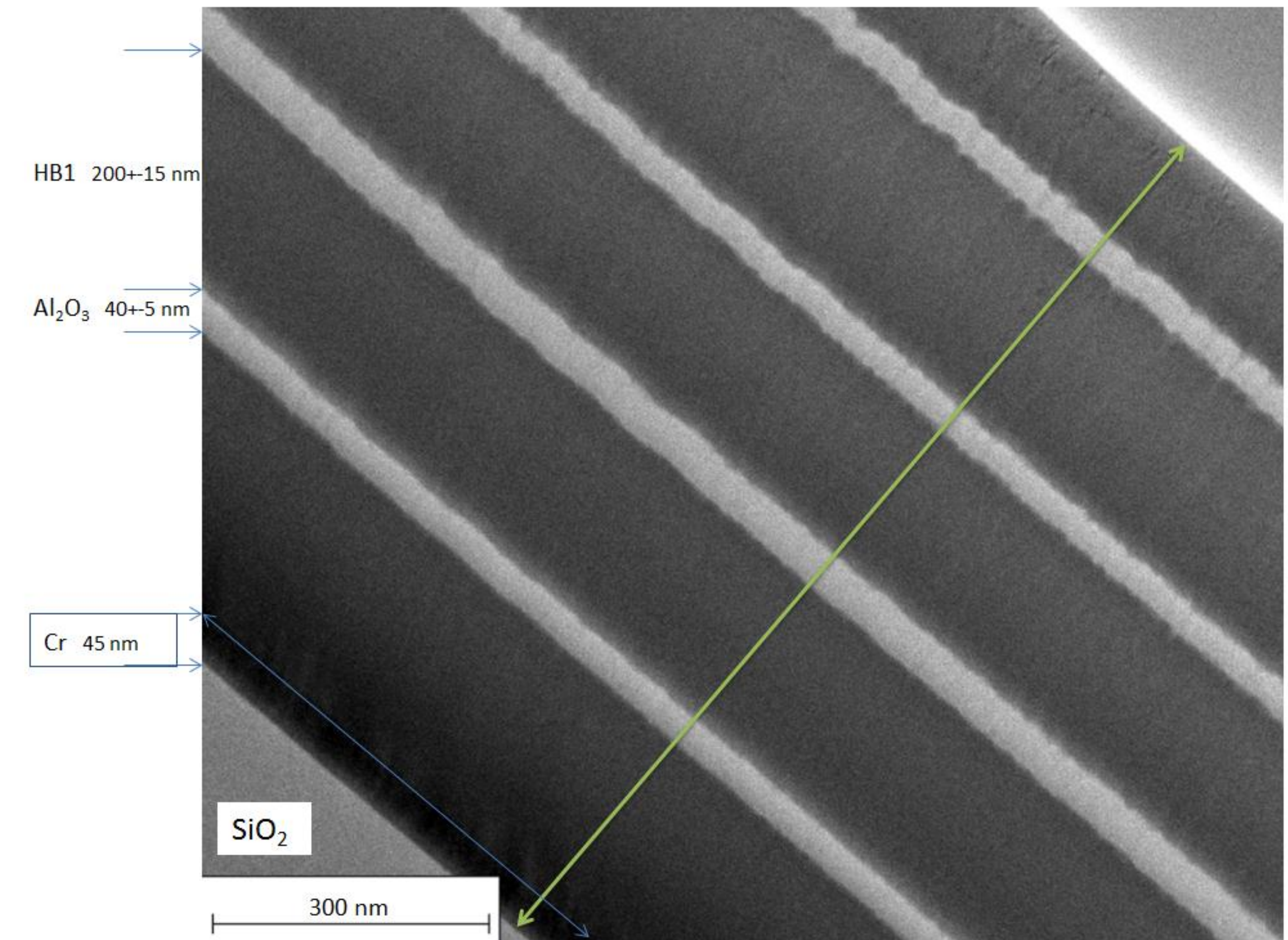
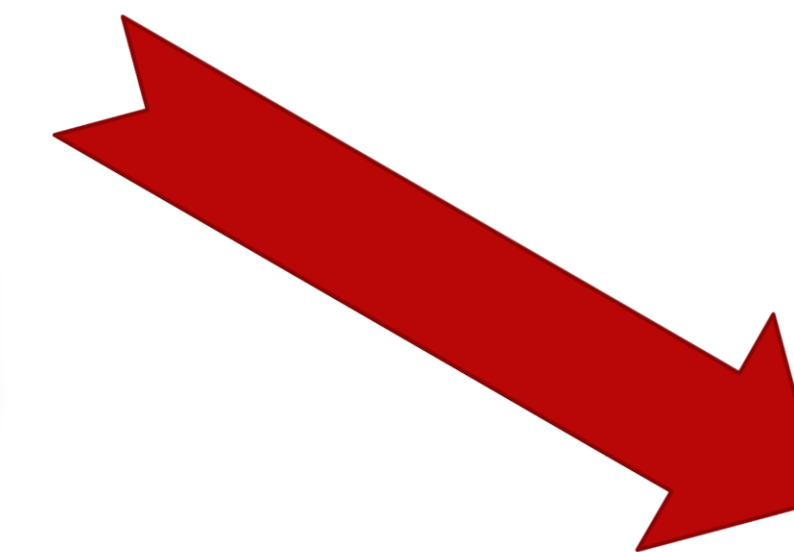
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From laminated cores...



...and bulk ferrites...



... to multilayered magnetic alloy/insulator thin films!

Advantages:

- Easy-to-make, with low-power DC and RF sputtering
- Can be easily deposited on wafers
- Extremely customizable to cover a wide range of different requirements
- Low cost through the use of widely available raw materials (Metglas® 2605HB1 and Al₂O₃)



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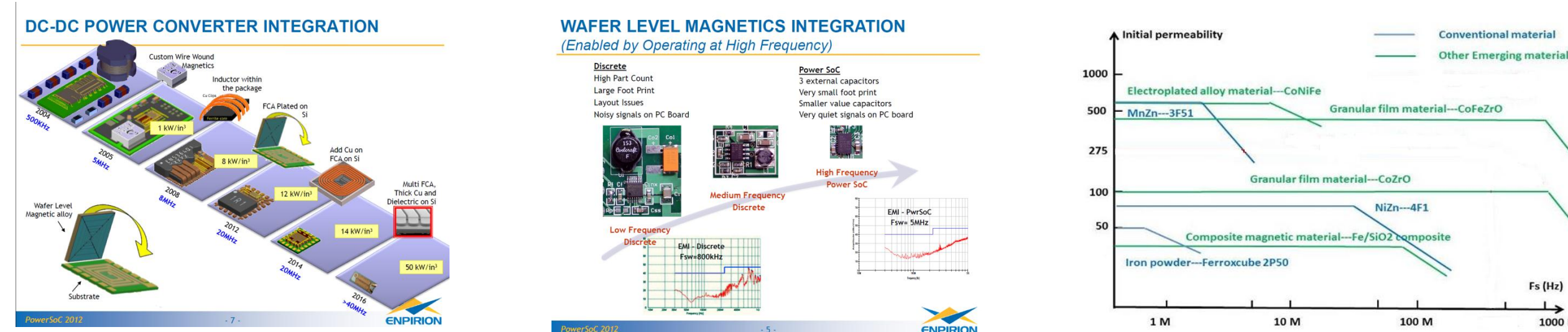
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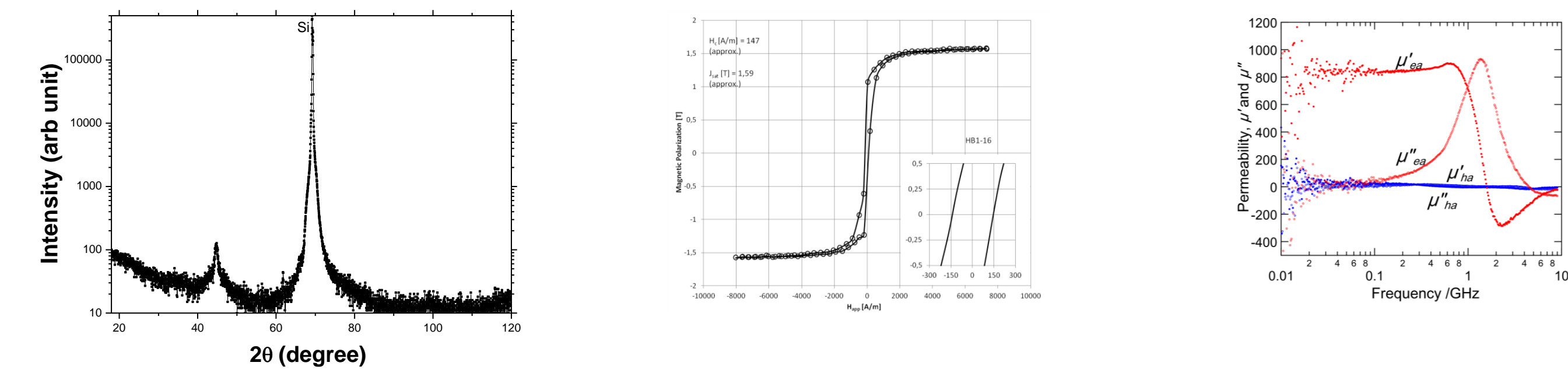
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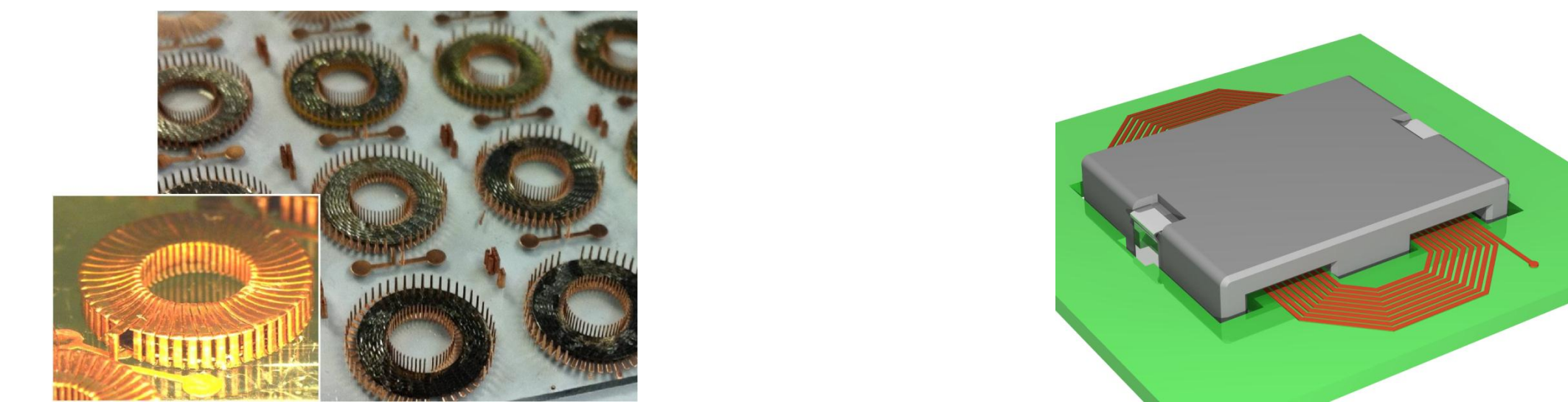
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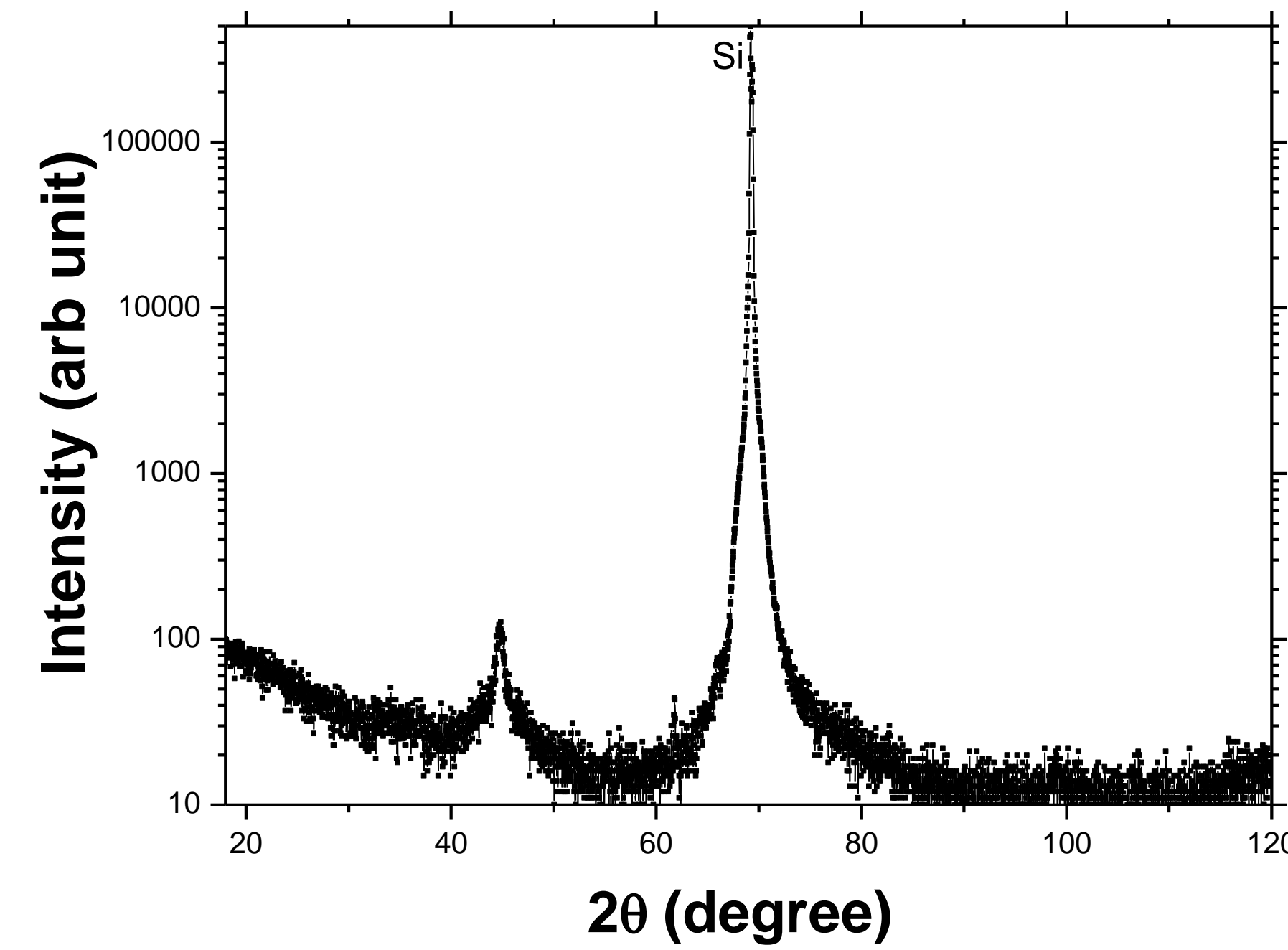
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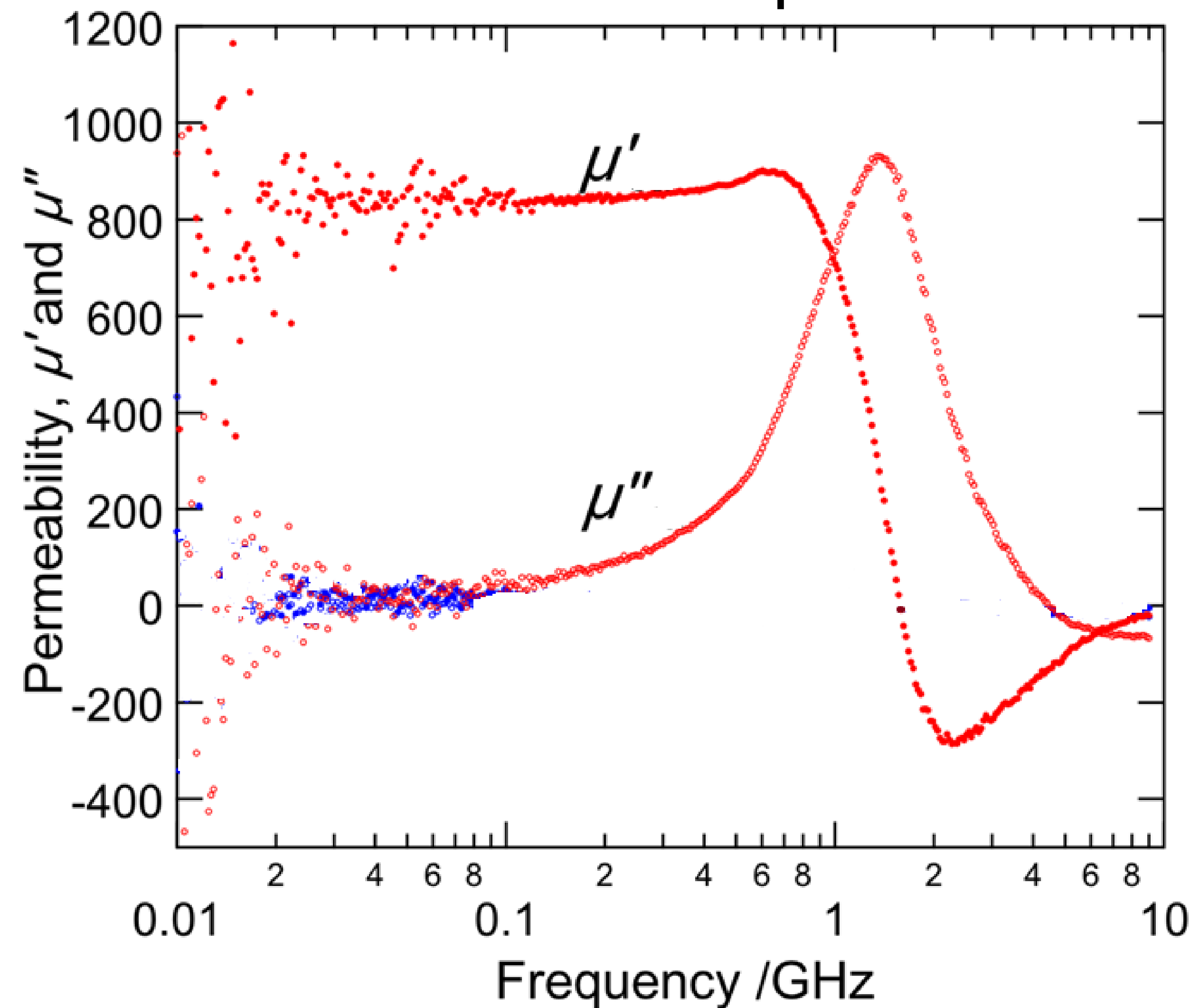
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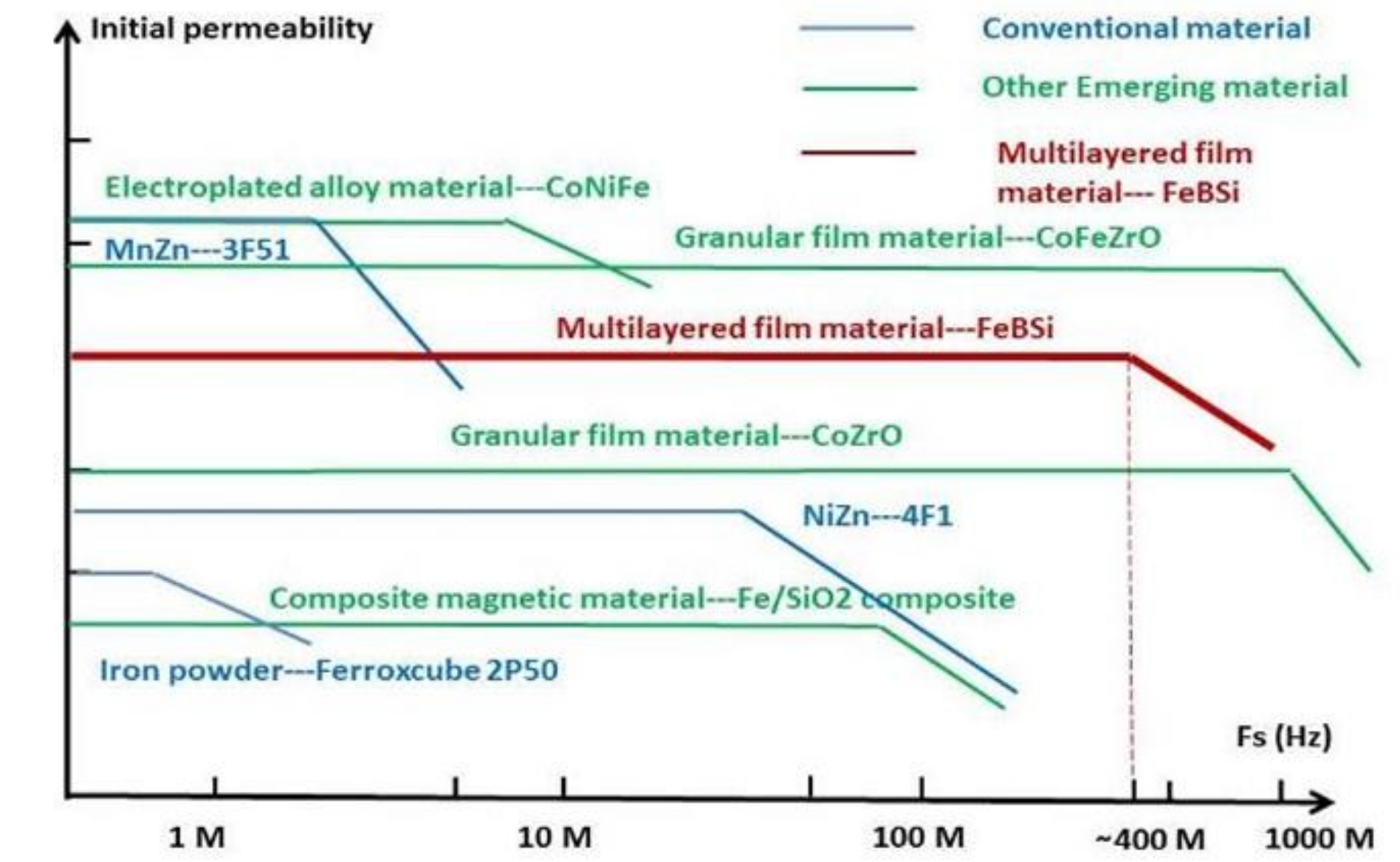


Amorphous films with no peaks suggesting the presence of crystallites

Latest sample



Real permeability is 850 up to 600MHz!!



Large permeability up to 400MHz



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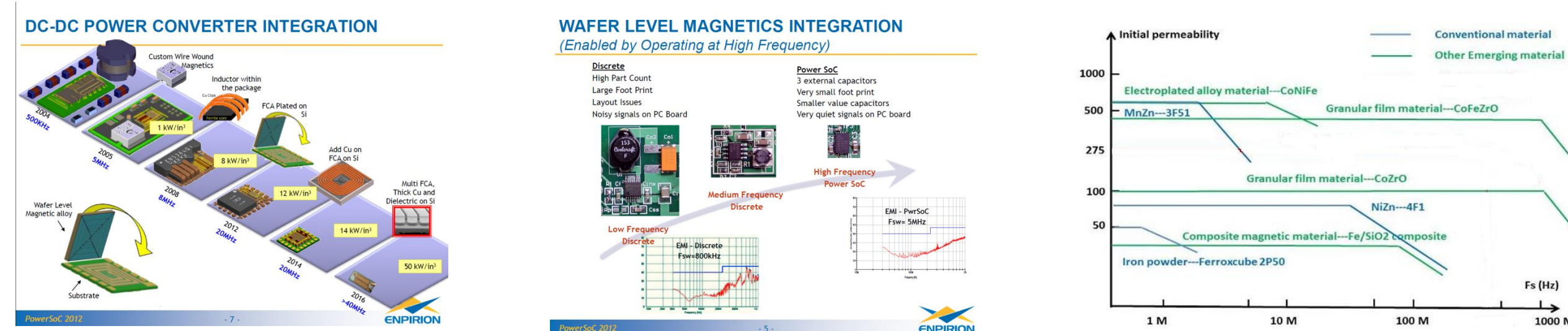
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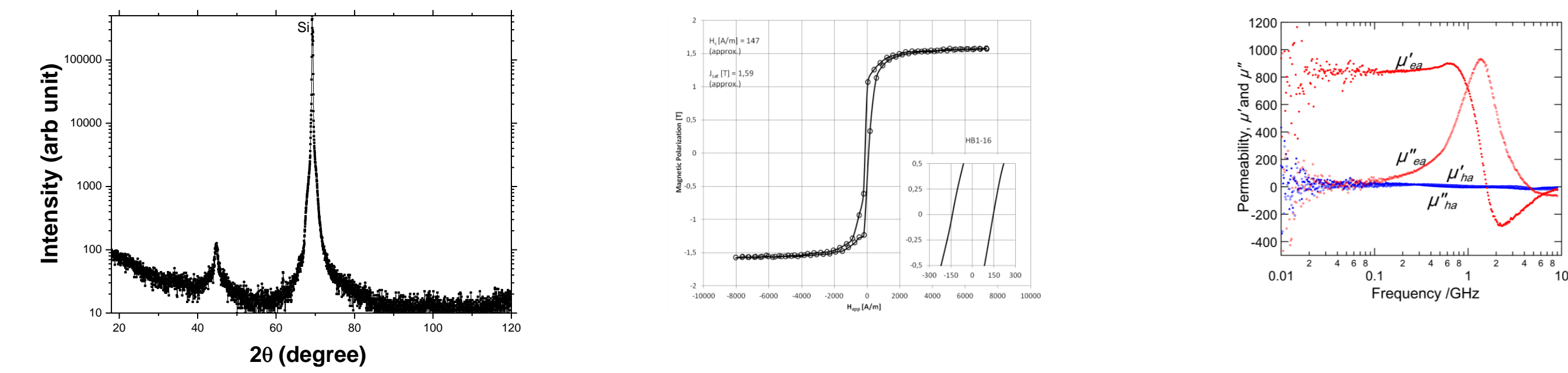
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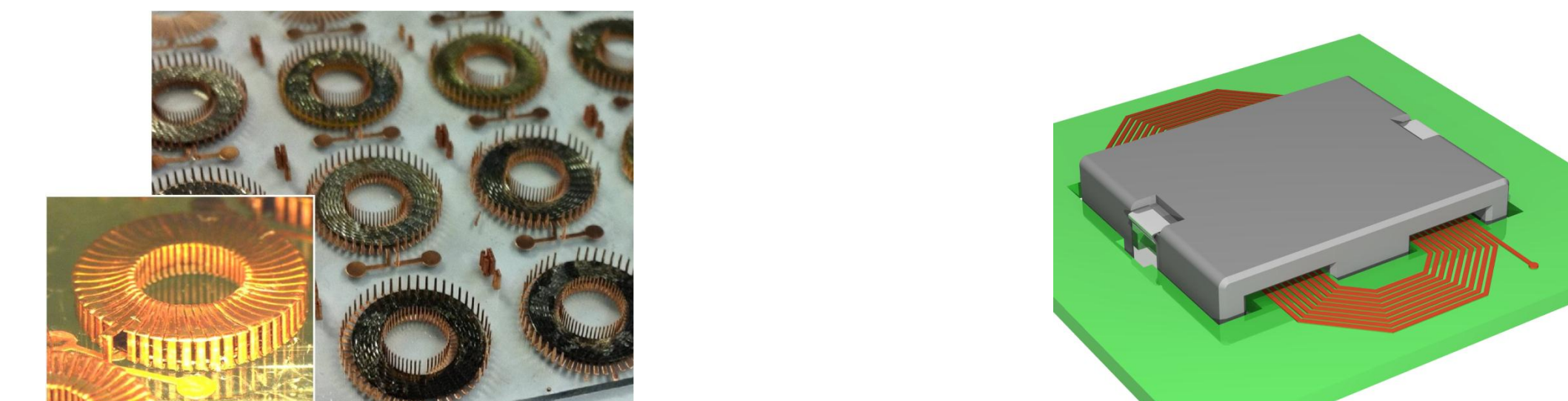
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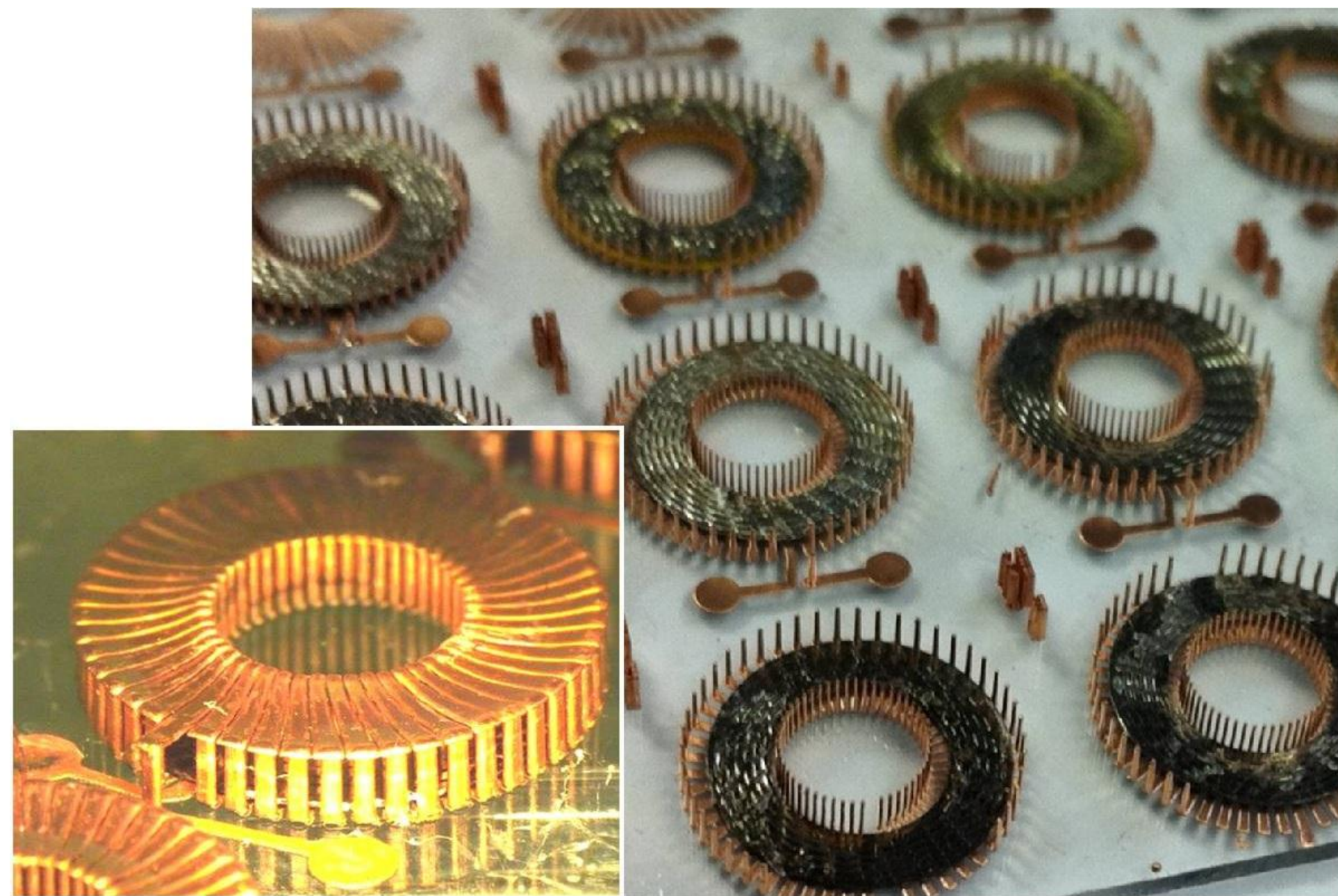
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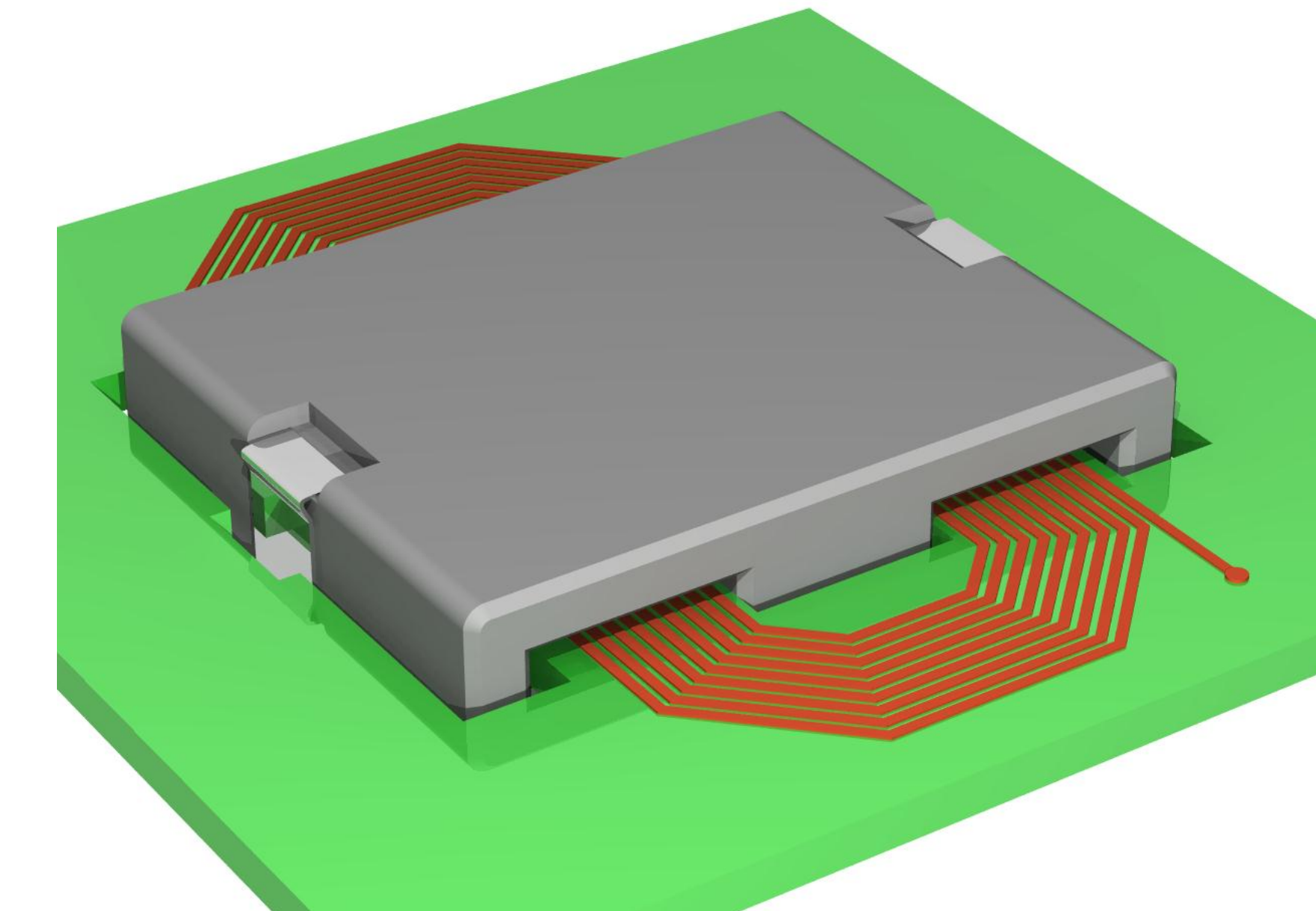
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Future work



Integration of multilayered films with on-chip inductors



Construction and characterization of integrated transformer