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Periodic Structures Manufactured by 3D Printing for Electron Beam Excitation of High Power Microwave Sources

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Periodic structures that reduce the velocity of electromagnetic wave propagation are widely used in electron beam driven high power microwave sources. When the frequency increases into the mm-wave region such structures become difficult to manufacture because of the small physical dimensions. “Additive Manufacturing” or “3D printing” offers the possibility of constructing certain types of components quickly, efficiently and relatively inexpensively [1]. Many questions arise however, including the structural resolution obtainable, the surface roughness, surface electrical resistivity and vacuum compatibility. To address some of these questions the performance of a periodic structure manufactured using a 3D printing technique and designed for W-band operation (75- 110GHz) is evaluated [2] and reported in the present work

[1] I. Gibson, D. Rosen and B. Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, 2nd Edition, (2015) Springer, New York, USA

[2] A.R. Phipps, A.J. MacLachlan, C.W. Robertson, L. Zhang, I.V. Konoplev, A.W. Cross, A.D.R. Phelp, “Electron Beam Excitation of Coherent Sub-Terahertz Radiation in Periodic Structures Manufactured by 3D Printing”, Nuclear Instruments and Methods in Physics Research B, accepted for publication 2017

Authors: CROSS, Adrian (University of Strathclyde); Dr KONOPLEV, Ivan V. (John Adams Institute / University of Oxford); Dr MACLACHLAN, Amy (University of Strathclyde / Cockcroft Institute); Prof. PHELPS, Alan D.R. (University of Strathclyde \ Cockcroft Institute); Mr PHIPPS, Alan R. (University of Strathclyde \ Cockcroft Institute); Dr ROBERTSON, Craig W. (University of Strathclyde); Dr RONALD, Kevin (university of Strathclyde / Cockcroft Institute); Dr ZHANG, Liang (University of Strathclyde)

Presenter: CROSS, Adrian (University of Strathclyde)

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