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Toward fabrication of mm-wave undulator cavities

Joshua J. Song

Argonne National Laboratory, APS/RF 371T, Argonne IL 60439

H. Henke

Technische Universitaet Berlin, Institut fuer institutions Theoretische Electrotechnik, Einsteinufer 17, 1000 Berlin 10, Germany

A. D. Feinerman

Department of Electrical Engineering and Computer Science, University of Illinois at Chicago, IL 60607

G. M. Wells and V. White

University of Wisconsin at Madison, Center for X-ray Lithography, Stoughton, WI 53589-3097

Y. W. Kang, R. L. Kustom, Barry Lai, F. E. Mills,
and A. Nassiri

Advanced Photon Source, Argonne National Laboratory, Argonne IL 60439

The possibility of fabricating mm-wave undulator cavities, using deep x-ray lithography techniques is being investigated. The fabrication process includes making precision x-ray masks, x-ray resist of poly-methyl-methacrylate (PMMA), developing process, and microelectroforming of the structure.

Highly precise two-dimensional features can be machined onto wafers by this techniques. Major challenges are fabrication of the wafers onto three-dimensional RF structures, alignment and overlay accuracy of the x-ray stepper, adhesion of the PMMA on the copper substrate, and developer selection for high resolution.

Rectangular cavity geometry is best suited to this fabrication technique. Status of wafer manufacture, alignment techniques using capillaries bond in precision grooves, and $2p/3$ 120-GHz 30-cell RF structure will be discussed. Some undulator characteristics of the mm-wave undulator can be also found in this paper.

More detail RF simulation, heat extraction analysis, beam dynamics due to the mm-wave undulator, and measurements on 10X larger scale models can be found in a separate paper.