

Development and Monte Carlo Analysis of Antiscatter Grids for Mammography

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Abstract

Mammography arguably demands the highest fidelity of all x-ray imaging applications, with simultaneous requirements of exceedingly high spatial and contrast resolution. Continuing technical improvements of screen-film and digital mammography systems have led to substantial improvements in image quality, and therefore improvements in the performance of anti-scatter grids are required to keep pace with the improvements in other components of the imaging chain. The development of an air-pore honeycomb (cellular) grid using x-ray lithography and electroforming techniques is described, and the production of a 60 mm × 60 mm section of grid is reported. A crossed grid was constructed with 25 μ m copper septa, and a period of 550 μ m. Monte Carlo and numerical simulation methods were used to analyze the theoretical performance of the fabricated grid, and comparisons with other grid systems (Lorad HTC and carbon fiber interspaced grids) were made over a range of grid ratios. The results demonstrate essentially equivalent performance in terms of contrast improvement factor (CIF) and Bucky factor (BF) between Cu and Au honeycomb grids and the Lorad HTC (itself a copper honeycomb grid). Gold septa improved both CIF and BF performance in higher kVp, higher scatter geometries. The selectivity of honeycomb grids was far better than for linear grids, with a factor of ~3.9 improvement at a grid ratio of 5.0. It is concluded that using the fabrication methods described, that practical honeycomb grid structures could be produced for use in mammographic imaging, and that a substantial improvement in scatter rejection would be achieved using these devices.