Fabricating Sub-collimating Grids for an X-ray Solar Imaging Spectrometer Using LIGA Techniques

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We are fabricating sub-collimating X-ray grids that are to be used in an instrument for the High Energy Solar Spectroscopic Imager (HESSI), a proposed NASA mission. The HESSI instrument consists of twelve rotating pairs of high aspect ratio, high Z grids, each pair of which is separated by 1.7 meters and backed by a single Ge detector. The pitch for these grid pairs ranges from 34 μm to 317 μm with the grid slit openings being 60% of the pitch. For maximum grid X-ray absorbing with minimum loss of the solar image, the grid thickness-to-grid-slit ratio must be approximately 50:1, resulting in grid thicknesses of 1 to 10 millimeters. For our proof-of-concept grids we have implemented a design in which a 34 μm pitch, free-standing *PMMA* grid is fabricated with 20 μm wide slits and an 800 μm thickness. Stiffeners that run perpendicular to the grid are placed every 500 μm. After exposure and developing, metal, ideally gold, is electrodeposited into the free-standing PMMA grid slits. The PMMA is *not* removed and the metal in the slits acts as the X-ray absorber grid while the PMMA holds the individual metal pieces in place, the PMMA being nearly transparent to the X-rays coming from the sun. For optimum imaging performance, the root-mean square pitch of the two grids of each pair must match to within 1 part in 10000 and simultaneous exposures of stacked sheets of PMMA have insured that this requirement is met.