Technology Development of Adjustable Grazing Incidence X-ray Optics for Sub-arc Second Imaging

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We report on technical progress made over the past year developing thin film piezoelectric adjustable grazing incidence optics. We believe such mirror technology represents a solution to the problem of developing lightweight, sub-arc second imaging resolution X-ray optics. Such optics will be critical to the development next decade of astronomical X-ray observatories such as SMART-X, the Square Meter Arc Second Resolution X-ray Telescope. SMART-X is the logical heir to Chandra , with 30 times the collecting area and Chandra -like imaging resolution, and will greatly expand the discovery space opened by Chandra's exquisite imaging resolution.

In this paper we discuss deposition of thin film piezoelectric material on flat glass mirrors. For the first time, we measured the local figure change produced by energizing a piezo cell – the influence function, and showed it is in good agreement with finite element modeled predictions. We determined that at least one mirror substrate material is suitably resistant to piezoelectric deposition processing temperatures, meaning the amplitude of the deformations introduced is significantly smaller than the adjuster correction dynamic range. Also, using modeled influence functions and IXO-based mirror figure errors, the residual figure error was predicted post-correction. The impact of the residual figure error on imaging performance, including any mid-frequency ripple introduced by the corrections, was modeled. These, and other, results are discussed, as well as future technology development plans.