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Optimization of multilayer reflectivity and bandpass for soft to hard x-ray applications [0.1-200 keV]

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In the last decades the major motivation for manufacturing multilayer mirrors has been in soft x-ray applications, particularly for astronomy, microlithography, and polarimetry. The advent of high energy synchrotron storage rings has provided new significant impetus emphasized on high energy applications and especially when flux, rather than resolution, is desired.

In this paper we present the reflection properties of the most promising multilayer material combinations for the energy range from 0.1 keV up to 200 keV. Previous calculations by Rosenbluth were limited to a maximum of 2 keV and to multilayers composed of pure elements and operating under normal incidence. As alloys might be essential for a smooth growth and/or for stability under high heat load, our screening consisted of a list of up to 300 solids having a melting point above 100 °C and that could be deposited in a sputtering process. A full computer search calculates 45000 mirror combinations for each energy and angle of operation, which are the only necessary input parameters. Other manufacture-related parameters can be specified to give a more realistic picture of the performance. In practice the number of layers is often limited: a non-periodic design is required to minimize absorption effects.