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Direct silicon-on-silicon bonding for construction of analyzers for inelastic scattering

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Analyzers for x-ray inelastic scattering with millivolt resolution must be bent spherically with minimal figure error and must retain very little strain. This can be accomplished either by grooving a flat wafer so that it retains only a thin back wall and then holding such a wafer on a spherical surface or by mounting separate blocks on a spherical surface. Obstacles to be overcome with any approach to analyzer construction are i) imperfect spherical figure perfection, ii) retained strain, and iii) loss of diffracting area. Direct bonding of silicon-on-silicon has been investigated by us as new means of mounting such analyzers on spherical forms. The technique has the inherent advantage that adhesion is achieved without an intermediary bonding agent. The thickness of a glue or an epoxy must necessarily be very uniform to achieve high figure perfection. We have demonstrated excellent figure perfection for a 75-mm-diameter, bonded, grooved wafer, and we will discuss our results for this process to date. The availability of this bonding method suggests new means of building analyzers that do not have a back wall, and these ideas will be presented.

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