B29

Replica grating radiation damage in a normal incidence monochromator

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Experience with the Synchrotron Radiation Center 4 meter normal incidence monochromator has revealed short operational life for the high energy gratings. Within periods as short as 6 months, the resolution of the gratings degraded sufficiently to limit the resolution to values expected with 80 micron slits. This decrease in resolution occurs without any noticeable changes in the efficiency or throughput of the grating. The resolution degradation has been shown to have been caused by light between 100 and 200 eV which was transmitted through the gold layer of the replica grating and causes shrinkage of the epoxy. This resulted in distortion of the surface. The problem was solved by ordering a special replica grating with a double layer of gold. Calculations indicate that a thicker gold layer should decrease the flux penetrating the epoxy layer by a factor of ten slowing down the deterioration of the grating figure. A grating with a double thickness gold layer has been operating in the monochromator for more than one year with no noticeable decrease in the resolution.