

High-Resolution Soft X-ray RIXS Using Active Gratings and Energy Compensation

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We have developed a unique technique for the high-efficiency and high-resolution beamline and spectrometer of inelastic soft X-ray scattering (RIXS). This new technique is based on the energy compensation principle of grating dispersion. The design of the monochromator–spectrometer system greatly enhances the measurement efficiency at least by one order of magnitude. The setup comprises two bendable gratings to effectively diminish the defocus and coma aberrations. A test RIXS beamline of this design has been constructed at Taiwan Light Source, showing total energy resolutions of 65 meV and 130 meV at 710 eV and 930 eV, respectively [1]. This test beamline has yielded successful RIXS experiments of cuprate superconductors [2]. A new RIXS beamline based on this design will be established at Taiwan Photon Source. To reduce the grating surface deformation, a special grating bender is designed by adopting a multipoint scheme. A CCD detector with a sub-pixel spatial resolution through a centroid algorithm will be used. Our simulations indicate that the expected energy resolving power is better than 66000 at 530 eV and 45000 at 900 eV, respectively, with an efficiency one order of magnitude better than that of a conventional design.

References

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- [2] W. S. Lee et al., "Asymmetry of collective excitations in electron and hole-doped cuprate superconductors," *Nature Physics* 10, 883(2014).

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