Notes for Authors

1. Scientific scope

The *Journal of Synchrotron Radiation* seeks to cover all aspects of synchrotron radiation thus bringing together the full range of interests and skills of the synchrotron radiation community. Contributions are invited within the general areas of instrumentation, methods and applications. Instrumentation papers covering synchrotron radiation sources and beamlines, optics, detectors, electronics and data acquisition, and sample chambers and environment are welcomed. Methods and applications papers are invited within the categories of diffraction, spectroscopy and imaging.

2. Categories of contributions

Contributions should conform to the general editorial style of the journal.

2.1. *Research Papers*

Full-length *Research papers* should not normally exceed the equivalent of about 10000 words.

2.2. *Short Communications*

Short Communications are intended for the presentation of topics of limited scope or for preliminary announcements of novel research findings. They are not intended for interim reports of work in progress, and must report results that are of scientific value in their own right.

Short Communications should not exceed two journal pages (about 1500 words). A maximum of two figures and two tables of appropriate size are permitted. They are refereed in the normal way.

2.3. *Fast Communications*

Fast Communications should not normally exceed the equivalent of about 2000 words. On submission of the paper, authors should state why rapid publication is essential. Papers submitted for the *Fast Communications* section but judged by the editor not to merit rapid publication will be considered for inclusion with regular papers.

2.4. *Reviews*

The Main Editors occasionally invite leaders in selected areas to write *Lead Articles*, which are forward-looking reviews of specific topics. In addition, unsolicited review articles may be submitted. A brief outline of the proposed article should first be sent to one of the Main Editors. All selected *Lead Articles* and review articles will be refereed in the usual manner. These articles should not normally exceed 15000 words.

2.5. *Computer Programs*

A brief description of the purpose, strategy, computer language, machine requirements, input requirements and the type of results obtained should be included. It is also ordinarily required that the adequacy of the documentation shall have been proven by the successful use of the program by someone outside the author's institution. *Computer Programs* should not normally exceed 5000 words. They are refereed in the normal way.

2.6. *Laboratory Notes*

These are very brief descriptions of special devices, equipment modifications, techniques for accomplishing certain tasks *etc.* A simple schematic drawing may often be preferable to an actual photograph of the apparatus. These articles should not normally exceed 500 words and will not be refereed.

2.7. *Computer Program Abstracts*

This section provides a rapid means of communicating up-to-date information concerning both new programs or systems and significant updates to existing ones. Either the names and addresses of those people outside the author's laboratory who have used and tested the program(s) or a source-code listing and test execution should be provided. These will be sent to the referees as supporting material but will not be published or deposited in any form. A *Computer Program Abstract* should not exceed 500 words in length and should use the standard format given in *J. Appl. Cryst.* (1985), **18**, 189–190.

2.8. *Letters to the Editor*

These may deal with non-technical aspects of synchrotron radiation, its role, its propagation, the proper functions of its Societies *etc.* or may make a technical observation or scientific comment that would usefully be brought to wider attention.

2.9. *New Commercial Products*

Announcements of new commercial products are published free of charge. The descriptions, up to 300 words or the equivalent if a figure is included, should give the manufacturer's full address.

2.10. *Synchrotron Radiation Meetings and Short Courses*

This section contains details of meetings of scientific societies, congresses, summer schools *etc.* that are of interest. Contributions should be sent to the Editorial Office in Chester.

3. Submission and handling of manuscripts

Papers should be submitted in one of two ways: as hard copy directly to the Managing Editor or electronically *via* the web. Electronic submission *via* the web will be introduced during 2001.

3.1. *Hard-copy submission*

Manuscripts and figures should be prepared using the file formats listed in §3.10. Three paper copies and the electronic file(s) should be submitted; authors are reminded to keep an exact copy of the submission for later editorial adjustments and for checking proofs. Hard-copy submissions should be sent to:

The Managing Editor
International Union of Crystallography
5 Abbey Square
Chester CH1 2HU
England

Telephone: 44 1244 342878
Fax: 44 1244 314888
E-mail: **med@iucr.org**
Ftp: **ftp.iucr.org** (192.70.242.1)

On acceptance, a final electronic publication-ready paper (see Appendix *B*) will be required by the Editorial Office.

Contact details for the editors are available at **http://journals.iucr.org/s/services/editors.html**. Editors are assigned to a paper according to their current workload and expertise. However, on submission authors should indicate the name of their preferred editor.

3.2. *Electronic submission*

Manuscripts and figures should be prepared using the file formats listed in §3.10. Full details of the submission procedure can be found at **http://journals.iucr.org/services/submit.html** and authors should first check this page to see if the service is available.

On acceptance, a final electronic publication-ready paper (see Appendix *B*) will be required by the Editorial Office.

3.3. *Languages of publication*

The languages of publication are English, French, German and Russian.

3.4. *Handling of manuscripts*

The Co-editor to whom the manuscript is assigned is responsible for choosing referees and for accepting or rejecting the paper. This responsibility includes decisions on the final form of the paper and interpretation of these Notes when necessary.

If changes to a manuscript requested by the editorial staff or the Co-editor are not received within **two months** of transmittal to the author, the submission will automatically be withdrawn. Any subsequent communication of the material will be treated as a new submission in the editorial process.

For accepted papers, it is the responsibility of the Managing Editor to prepare the paper for printing. This may involve correspondence with the authors and/or the responsible editor in order to resolve ambiguities or to obtain a satisfactory publication-ready paper. The date of acceptance that will appear on the published paper is the date on which the Managing Editor receives the last item required. Correspondence will be sent to the author who submitted the paper unless the Managing Editor is informed of some other suitable arrangement.

On rare occasions, an editor may consider that a paper is better suited to another IUCr journal. Alterations to the journal of publication will only be made after full discussion with the communicating author.

3.5. *Author's warranty*

The submission of a paper is taken as an implicit guarantee that the work is original, that it is the author(s) own work, that all authors concur with and are aware of the submission, that all workers involved in the study are listed as authors or given proper credit in the acknowledgments, that the manuscript has not already been published (in any language or medium), and that it is not being considered and will not be offered elsewhere while under consideration for an IUCr journal.

3.6. *Copyright*

Except as required otherwise by national laws, an author must sign and submit a copy of the Transfer of Copyright Agreement form (Appendix *A*) for each manuscript before it can be accepted. During the electronic submission process, authors will be asked to transfer copyright electronically.

3.7. *Author grievance procedure*

An author who believes his paper has been unjustifiably treated by the Co-editor may appeal to one of the Main Editors for a new review.

3.8. *Contact e-mail address*

The contact author must provide an e-mail address for editorial communications and despatch of electronic proofs.

3.9. *Electronic publication-ready paper*

Authors whose papers are accepted for publication will be asked to produce the final electronic publication-ready paper (see Appendix *B*). This will be reviewed by the IUCr Editorial Office staff, who may request revisions on technical grounds.

3.10. *File format*

The manuscript should be prepared using TEX, LATEX or Word. Authors are encouraged to use the templates available from the Editorial Office by e-mail (**med@iucr.org**) or by ftp (from the 'templates' directory). All Word submissions should be accompanied by an RTF (rich text format) file.

Figures may be provided in PostScript, encapsulated PostScript or TIFF formats. The resolution of bitmap graphics should be a minimum of 1200 d.p.i.

3.11. *File transfer*

For electronic submissions the files should be uploaded *via* the web. Full details of this procedure are given at **http://journals.iucr.org/services/submit.html**.

For hard-copy submissions final electronic files must have a filename constructed from the *reference number* supplied by the Co-editor. Files should be given the extensions `.tex`, `.doc` and `.rtf` as appropriate. Illustrations should be given the extensions `.ps`, `.eps` or `.tif`. Multiple files for the same submission should be identified by filenames constructed as *`ref.id.ext`* where *`id`* indicates the contents, *e.g.* `xz1087.fig1.ps` and `xz1087.fig2.ps`. Only after acceptance of the paper by the responsible editor should the final electronic publication-ready paper (see Appendix B) be sent to the Editorial Office in Chester. This may be by e-mail (med@iucr.org), on diskette or (for files larger than 70K bytes) by ftp as described below.

(i) On your workstation enter:	**`ftp ftp.iucr.org`**
(ii) Wait for **`Name`**...: prompt and enter:	**`anonymous`**
(iii) Wait for **`Password`**: prompt and enter:	*`your e-mail address`*
(iv) Wait for **`ftp>`** prompt and enter:	**`cd incoming/s`**
(v) Transfer a file from your account (*e.g.* j29.ps) as an identifiable name (*e.g.* ja0325.ps):	**`put j29.ps ja0325.ps`**
(vi) Wait for **`ftp>`** prompt before sending another file	
(vii) Finish off the ftp session by entering:	**`bye`**
(viii) Send an e-mail to Chester (**`med@iucr.org`**) with a list of the files transferred by ftp.	

4. Abstract, synopsis and keywords

All scientific contributions must be preceded by an English language *Abstract* and a one or two sentence *Synopsis* of the main findings of the paper for inclusion in the Table of Contents. The *Abstract* should state concisely the principal results obtained.

The *Abstract* should be suitable for reproduction by abstracting services without change in wording. It should not repeat information given in the title. Ordinarily 200 words suffice for *Abstracts* of a full-length article and 100 words for shorter contributions. It should make no reference to tables, diagrams or formulae contained in the paper.

It should not contain footnotes. Numerical information given in the *Abstract* should not be repeated in the text. It should not include the use of 'we' or 'I'.

Literature references in an *Abstract* are discouraged. If a reference is unavoidable, it should be sufficiently full within the *Abstract* for unambiguous identification, *e.g.* [Smith (1998). *J. Synchrotron Rad.* **5**, 21–31].

Authors should ideally supply at least five keywords.

5. Diagrams and photographs ('figures')

Figures should be prepared using one of the file formats listed in §3.10.

The choice of tables and figures should be optimized to produce the shortest printed paper consistent with clarity. Duplicate presentation of the same information in both tables and figures is to be avoided, as is redundancy with the text. In a paper only those figures which are strictly necessary to illustrate the techniques or results described will be published: any others will be deposited. The text should be adequate to give the remaining information.

In papers which use powder profile fitting or refinement (Rietveld) methods, figures which present the experimental and calculated diffraction profiles of the material studied should also contain the difference profile. As primary diffraction data cannot be satisfactorily extracted from such figures, the basic digital diffraction data should be deposited (see §11.3)

5.1. *Quality*

Hard-copy greyscale images should be provided as glossy prints; laser printer or photocopier output will generally be unsatisfactory for reproduction of such diagrams. High-resolution laser printer output is satisfactory for line drawings.

5.2. *Size*

Diagrams should be as small as possible consistent with legibility.

5.3. *Lettering and symbols*

Fine-scale details and lettering must be large enough to be clearly legible (ideally 1.5–3 mm in height).

Lettering should be kept to a minimum; descriptive matter should be placed in the legend.

5.4. *Numbering and legends*

Diagrams should be numbered in a single series in the order in which they are referred to in the text.

6. Tables

6.1. *Economy in use of tables*

Numerical information is generally most economically presented in tables. Text and diagrams should not be redundant with the tables.

6.2. *Design, numbering and size*

Tables should be numbered in a single series of arabic numerals in the order in which they are referred to in the text. They should be provided with a caption.

Tables should be carefully designed to occupy a minimum of space consistent with clarity.

7. Mathematics and letter symbols

Authors submitting in Word should use the Word equation editor to prepare displayed mathematical equations.

The use of the stop (period) to denote multiplication should be avoided except in scalar products. Generally no sign is required but, when one is, a multiplication sign ($\times$) should be used.

Vectors should be in bold type and tensors should be in bold-italic type.

Greek letters should not be spelled out.

Care should be taken not to cause confusion by using the same letter symbol in two different meanings.

Gothic, script or other unusual lettering should be avoided. Another typeface may be substituted if that used by the author is not readily available.

Equations, including those in published Appendices, should be numbered in a single series.

8. Multimedia

Multimedia additions to a paper (*e.g.* time-lapse sequences, three-dimensional structures) are welcomed; they will be made available *via Crystallography Journals Online*.

9. Nomenclature

9.1. *Crystallographic nomenclature*

Authors should follow the general recommendations produced by the IUCr Commision on Crystallographic Nomenclature (see reports at http://www.iucr.org/iucr-top/comm/cnom/).

Atoms of the same chemical species within an asymmetric unit should be distinguished by an appended arabic numeral. **Chemical and crystallographic numbering should be in agreement wherever possible**. When it is necessary to distinguish crystallographically equivalent atoms in different asymmetric units the distinction should be made by lower-case roman numeral superscripts (*i.e.* i, ii, iii *etc.*) to the original atom labels.

9.2. *Nomenclature of chemical compounds etc.*

Names of chemical compounds and minerals are not always unambiguous. Authors should therefore quote the chemical formulae of the substances dealt with in their papers.

Chemical formulae and nomenclature should conform to the rules of nomenclature established by the International Union of Pure and Applied Chemistry (IUPAC), the International Union of Biochemistry and Molecular Biology (IUBMB), the International Mineralogical Association and other appropriate bodies. As far as possible the crystallographic nomenclature should correspond to the systematic name.

Any accepted trivial or nonsystematic name may be retained, but the corresponding systematic (IUPAC) name should also be given.

9.3. *Units*

The International System of Units (SI) is used except that the ångström (symbol Å, defined as 10^{-10} m) is generally preferred to the nanometre (nm) or picometre (pm) as the appropriate unit of length. Recommended prefixes of decimal multiples should be used rather than '$\times 10^n$'.

10. References

References to published work must be indicated by giving the authors' names followed immediately by the year of publication, *e.g.*

Neder & Schulz (1998) or (Neder & Schulz, 1998). Where there are three or more authors the reference in the text should be indicated in the form Smith *et al.* (1998) or (Smith *et al*., 1998) *etc*. (all authors should be included in the full list).

In the reference list, entries for journals [abbreviated in the style of *Chemical Abstracts* (the abbreviations *Acta Cryst.*, *J. Appl. Cryst.* and *J. Synchrotron Rad.* are exceptions)], books, multi-author books, computer programs, personal communications and undated documents should be arranged alphabetically and conform with the style shown below.

Note that **inclusive** page numbers must be given.

Sample reference list

Andrews, M., Wright, H. & Clarke, S. A. (1998). In preparation.
Bürgi, H.-B. (1989). *Acta Cryst.* B**45**, 383–390.
Ferguson, G., Schwan, A. L., Kalin, M. L. & Snelgrove, J. L. (1997). *Acta Cryst.* C**53**, IUC9700009.
Hervieu, M. & Raveau, B. (1983*a*). *Chem. Scr.* **22**, 117–122.
Hervieu, M. & Raveau, B. (1983*b*). *Chem. Scr.* **22**, 123–128.
International Union of Crystallography (2000). *(IUCr) Journal of Synchrotron Radiation*, http://journals.iucr.org/s/journalhomepage.html.
International Union of Crystallography (2001). *(IUCr) Structure Reports Online*, http://journals.iucr.org/e/journalhomepage.html.
Jones, P. T. (1987). Personal communication.
McCrone, W. C. (1965). *Physics and Chemistry of the Organic Solid State*, Vol. 2, edited by D. Fox, M. M. Labes & A. Weissberger, pp. 725–767. New York: Interscience.
Perkins, P. (undated). PhD thesis, University of London, England.
Sheldrick, G. M. (1976). *SHELX*76. *Program for Crystal Structure Determination.* University of Cambridge, England.
Smith, J. V. (1988). *Chem. Rev.* **88**, 149–182.
Smith, J. V. & Bennett, J. M. (1981). *Am. Mineral.* **66**, 777–788.
Vogel, A. (1978). *Textbook of Practical Organic Chemistry*, 4th ed. London: Longman.

11. Supplementary publication procedure (deposition)

11.1. *Purpose and scope*

Parts of some papers are of interest to only a small number of readers, and the cost of printing these parts is not warranted. Arrangements have therefore been made for such material to be deposited with the IUCr electronic archive, with the Protein Data Bank, the Nucleic Acid Database and the ICDD as appropriate.

11.2. *IUCr electronic archive*

All material for deposition in the IUCr electronic archive should be supplied electronically.

Non-structural information, which may include:

details of the experimental procedure;

details of the stages of structure refinement;

details of mathematical derivations given only in outline in the main text and in mathematical Appendices;

lengthy discussion of points that are not of general interest or that do not lead to definite conclusions but that do have significant value;

additional diagrams,

should be supplied in one of the formats given in §3.10.

Structural information (for small-molecule structures) should be supplied in CIF format; structure factors should be supplied as .fcf files.

11.3. *Powder diffraction data*

Authors of powder diffraction papers should consult the notes provided at the online CIF help page (http://journals.iucr.org/c/services/cifhelp.html).

For papers that present the results of powder diffraction profile fitting or refinement (Rietveld) methods, the primary diffraction data, *i.e.* the numerical intensity of each measured point on the profile as a function of scattering angle, will be deposited.

11.4. *Macromolecular structures*

Authors should follow the deposition recommendations of the IUCr Commission on Biological Macromolecules [Commission on Biological Macromolecules (2000). *Acta Cryst.* D**56**, 2]. For all structural studies of macromolecules, coordinates and structure factors must be deposited with the Protein Data Bank or the Nucleic Acid Database if a total molecular structure has been reported. Authors must supply the Protein Data Bank/Nucleic Acid Database reference codes before the paper can be published.

11.5. *XAFS data*

For papers that present XAFS data of an unknown system, the deposition of primary $\chi(K)$ data will be encouraged.

11.6. *Other spectroscopic, diffraction and imaging data*

Deposition of primary data is generally encouraged. Please enquire prior to submission as regards preferred format.

12. *Crystallography Journals Online*

All IUCr journals are available on the web *via Crystallography Journals Online*; http://journals.iucr.org/. Full details of author services can be found at http://journals.iucr.org/s/services/authorservices.html.

12.1. *Electronic status information*

Authors may obtain information about the current status of their papers at http://journals.iucr.org/services/status.html.

12.2. *Proofs*

Proofs will be provided in portable document format (pdf). The correspondence author will be notified by e-mail when the proofs are ready for downloading.

12.3. *Reprints*

After publication, the correspondence author will be able to download the electronic reprint of the published article, free of charge. Authors will also be able to order printed reprints at the proof stage.

APPENDIX *A*

International Union of Crystallography
Transfer of Copyright Agreement

Title of Article (*Please type or use capital letters*)

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Authors (*Please type or use capital letters*)

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The signed statement must be received before the article can be accepted for publication. Requests for further information should be sent to the Executive Secretary of the Union.

† In this case please give further details overleaf.

For use of the International Union of Crystallography only.

M. E. Reference	Coeditor No.	Issue	Journal

This form may be photocopied.

APPENDIX *B*
Instructions for electronic publication-ready papers

All papers will be printed in publication-ready format. Publication-ready copy should be prepared according to the following instructions. Please read these carefully, as publication-ready copy that does not conform to these instructions will be returned for correction.

(1) The paper should be submitted according to Section 3 of Notes for Authors. You do not need to prepare the publication-ready copy until your paper has been **accepted** by the Co-editor.

(2) The style of a publication-ready paper in the *Journal of Synchrotron Radiation* is shown on the following pages. The detailed typographic specifications are as follows:

Layout details

Page size (text area):	183 × 238 mm
Column width:	88 mm
Space between columns:	7 mm

Fonts and spacing

Title:	**12 pt bold Helvetica**
Authors:	**10 pt bold Helvetica**
Affiliations:	*9 pt oblique Helvetica*
Abstract:	9 pt Times Roman
Keywords:	**8 pt bold Helvetica**
Headings	
Level 1:	**8 pt bold Helvetica, aligned left**
Level 2:	*8 pt oblique Helvetica, aligned left*
Level 3:	*8 pt oblique Helvetica, at start of paragraph*
Text:	9 pt Times Roman
References:	8 pt Times Roman
Figure captions:	8 pt Times Roman
Table captions:	8 pt Times Roman
Table text:	7 pt Times Roman
Footnotes:	8 pt Times Roman

If you do not have Helvetica fonts available, please use Univers or another sans-serif font.

(3) Electronic templates (LaTeX and WORD) are available by ftp from the address ftp.iucr.org in the directory 'templates/jsr'. The above styles are already set up in these templates.

(4) Once your paper has been accepted, the Co-editor will ask you to provide (*a*) the completed publication-ready copy, (*b*) an electronic version of the paper in LaTeX or WORD, (*c*) originals of all figures and (*d*) electronic versions of all figures in PostScript, Encapsulated PostScript or TIFF format. Please send the material to the Co-editor in a rigid card envelope to ensure it is not damaged in the post.

(5) When the publication-ready copy has been approved by the Co-editor, it will be forwarded to the Editorial Office in Chester for publication. If additional material is required by the Editorial Office, it should be submitted following the procedures given in Section 3.11 of Notes for Authors.

Design and performance of a multilayered mirror monochromator in the low-energy region of the VUV

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For the energy region from tens to hundreds of electron volts, the multilayered mirror (MLM) monochromator has never been realized due to the difficulty of reducing the background noise of the total reflection component, in spite of its useful… synchrotron radiation experiments. In this work, a … type MLM monochromator equipped wit… been designed on the basis of … driving system and of Mo/… has been evaluat… shown th… with an … practical … backgroun…

Keywords: m… layered mirror mono-chromators.

1. Introduction

Studies of synchrotron-radiation-stimulated processes such as etching and chemical vapour deposition (CVD) began about 12 years ago (Urisu & Kyuragi, 1987) and are still attracting much interest from many researchers. The vacuum ultraviolet (VUV) photons in synchrotron radiation can excite almost all the electronic states of molecules, so a large variety of chemical reaction channels different from that in the usual thermal-CVD are expected to be opened by synchrotron radiation irradiation. In particular, core electrons, which cannot be excited using lasers, are efficiently excited by the VUV photons in synchrotron radiation. The excitation-energy dependence of a photochemical reaction is important basic data. However, it has not been sufficiently investigated in the VUV region, because of the difficulty in obtaining energy-tunable monochromated light with sufficient photon flux ($>10^{13}$ photons s^{-1}) in the VUV region.

A multilayered mirror (MLM) monochromator is already in use in the high-energy region of the VUV (Barbee *et al.*, 1987). Concerning the low-energy regions, one of the present authors previously tried to use an MLM as a dispersion element in synchrotron-radiation-stimulated experiments. However, this was unsuccessful due to the difficulty in removing the background noise, consisting of total reflection components appearing at less than a few tens of eV. Therefore, in this work, we have designed a double-crystal-type MLM (Golovchenko *et al.*, 1981; Murata *et al.*, 1992) monochromator combined with an appropriate thin-film filter. The design is based on the trial fabrication of MLMs and the driving system for them. We have found that the low-energy background noise is sufficiently removed by using the MLMs at low incident angles combined with a carbon or molybdenum filter.

2. Design of the monochromator and mirrors

2.1. *Monochromator*

We adopted the monochromator driving system proposed by Golovchenko *et al.* (1981). The centres (*A* and *B*, respectively) of the first and the second MLMs are set on the *XY* and *YZ* lines which form a rigid right angle *XYZ*, with the first MLM parallel and the second perpendicular to the *XY* … lines, respectively. A pulsed motor drive sli… of the *XYZ* linearly, keeping the rot… ond mirror fixed. The first mi… ond mirror so that it … the apex … so that … r in an … using the … ement is also effec… higher-order photons. The … creases as the incident angle to the … mechanical linkage and driving system have … so that the beam incident angle can be adjusted … incident angles as small as possible. The present prototype driving system has successfully covered an incident beam angular range (θ) of 10–80°.

2.2. *MLMs*

The important photon energy region for the experimental investigation of synchrotron radiation processes, especially of the core-electron excitation processes, is from a few tens to hundreds of electron volts. In the present work our attention was focused on the region between 60 and 120 eV, a region for which fairly high reflectivity is obtained by using Mo/Si (for 60−90 eV) and

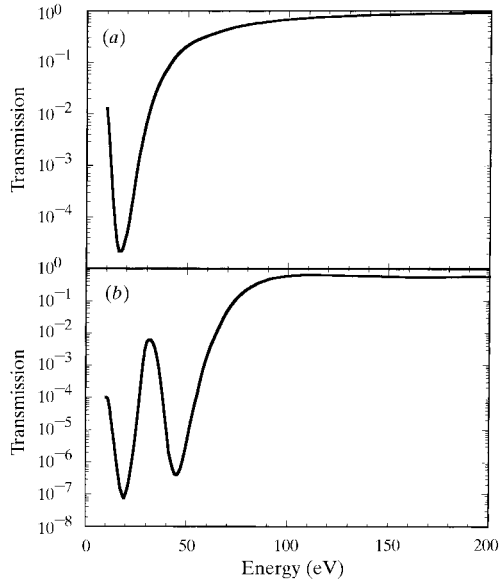

Figure 1
The calculated transmission for (*a*) a 100 nm-thick carbon filter and (*b*) a 100 nm-thick molybdenum filter.

Table 1
Specifications of optical components.

Component	Specifications	
Mo/Si MLM	Substrate	Si wafer (40 × 40 mm)
	Number of layers	20
	Period, d	12.5 nm (12.4 nm)†
	Thickness ratio, Mo/Si	3/7 (3.25/6.75)†
	Interface roughness, σ	(0.4 nm)†
Mo/C MLM	Substrate	Si wafer (40 × 40 mm)
	Number of layers	50
	Period, d	7.5 nm (7.9 nm)†
	Thickness ratio, Mo/C	1/1 (5.5/4.5)†
	Interface roughness, σ	(0.4 nm)†

† Values determined by fitting to the observed Cu $K\alpha$ line diffraction curves.

Mo/C (for 85–120 eV) MLMs. This energy region includes the core-electron binding energies of Al (2*s*: 119 eV; 2*p*: 74 eV) and Si (2*p*: 103 eV), which are important materials in semiconductor processes. To reduce the background noise in the low-energy region due to the total reflection, it is necessary to use the MLM at low incident angles. The Mo/Si and Mo/C MLMs were therefore designed so that they could cover the Al 2*s* and 2*p* and Si 2 binding energies in the incident angle range of 10–50° more, the detailed structural parameters have that the reflectivity is high and the re trical. Both Mo/Si and Mo/C meters listed in Table using the Cu *K* Corpora between roughness Porteus, 19 are listed in

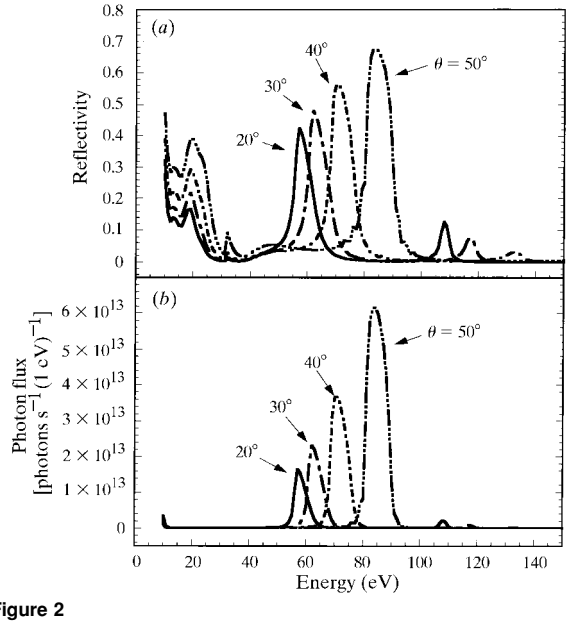

Figure 2
(*a*) Calculated reflectivity for the Mo/Si MLM and (*b*) output photon flux of the monochromator using Mo/Si MLMs plus C filter for a 100 mA ring current and a 16.56 × 12.79 mrad^2 acceptance angle of the pre-mirror, assuming that the monochromator is set up in the beamline BL-4A1 of the UVSOR.

2.3. *Thin-film filters*

The transmission characteristics of the thin-film filter have been calculated for several materials and it has been found that carbon and molybdenum are useful for reducing the background noise at energies below 70 eV. The transmission spectra calculated for 100 nm-thick carbon and molybdenum film filters are shown in Figs. 1(*a*) and 1(*b*), respectively.

3. Performance of the monochromator

The performance of the MLM monochromator, designed as described above, was evaluated by calculating what the basic characteristics, such as output photon flux, resolution, monochromaticity and tuning range, would be if the monochromator were set up as part of the beamline (BL4 e synchrotron radiation storage ring at the UVSO ne, the beam emitted from the bendin is reflected by an elliptical m ngle of 4°. The hori 0 cm and m from 6.1 m about 0.5 × as calculated for a on the recurrent equation (Spiller, and Mo/C MLMs were first calculated by or parameters listed in Table 1, as shown in Fig. 2(*a*) the Mo/Si case. It is known that extremely large total-reflection components appear at less than 40 eV in the case of Mo/Si.

The output beam photon fluxes calculated for various incident angles are shown in Fig. 2(*b*) for the case of Mo/Si MLM plus C filter. It is clearly shown that the filter drastically reduces the low-energy background noise. It is less than 1% (3%) of the main flux, where the value in parentheses is for the case of Mo/C MLM plus Mo filter. The higher-order photons background noise is less than 4% (0.1%). The calculated photon flux is 1 × 10^{14} to 5 × 10^{14} photons s^{-1} (3 × 10^{13} to 4 × 10^{13} photons s^{-1}) and the resolution is 5–9 eV (2–4 eV) FWHM. The calculated results are similar to those obtained with a typical undulator. Given that the MLM monochromator can select the photon energy continuously and that the mixing of higher-order photons is small, it is suggested that the present monochromator will be better than an undulator for use in synchrotron radiation experiments. We conclude from this work that the background noise due to the total reflection, which prevented the MLM monochromator from being used in the VUV low-energy region, can be sufficiently reduced by using double-crystal-type MLMs at low incident angles combined with a carbon or molybdenum thin-film filter.

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238 mm
88 mm
183 mm