

to approximately 30 Primarily Undergraduate Institutions (PUIs); offering training workshops, focusing upon utilization of the CSDS in chemistry education, to faculty at these PUIs; collaborating with the Cambridge Crystallographic Data Centre (CCDC) to build teaching modules making effective use of the CSDS; and encouraging faculty to prepare their own teaching modules. Details regarding the NSF-DCF project and examples of CSDS related chemistry teaching modules will be presented.

Keywords: education, database, e-learning

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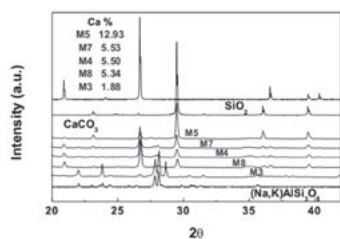
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X-ray diffraction applied to calcium determination in Mexican clays for Talavera production

Raul Delgado-Macuil¹, Marlon Rojas-Lopez¹,
Valentin Lopez-Gayou¹, Abdu Orduna-Diaz¹, Xim Bokhimi²,
Manuel Aguilar²

¹Instituto Politécnico Nacional, CIBA, Carretera Estatal Santa Ines Tecuexcomac-Tepetitla Km. 1.5, Tepetitla de Lardizabal, Tlaxcala, 90700, Mexico, ²Universidad Nacional Autonoma de Mexico, Facultad de Fisica, Mexico D.F., E-mail: rdmacuil@yahoo.com.mx

Eight types of clays used by the craftsmen of Tlaxcala Mexico, in the elaboration of the recognized world-wide level Mexican Talavera ceramic, were analyzed (M1-M8). The presence of calcium, iron and feldspars, in the samples, gives to the clay, malleability in its handling and hardness. EDX spectra of analyzed clays, showed the presence of: calcite (CaCO₃), quartz (SiO₂) and the feldspar ((Na,K)AlSi₃O₈). EDX results, in atomic percentage, showed that only a half of the samples had Ca and Na (M4, M5, M7 and M8). And M3 is the sample with the higher feldspar concentration. The sample M5 was the only one that showed to have the best relation between these three components (CaCO₃, SiO₂, (Na, K)AlSi₃O₈). The clay samples were also analyzed by infrared spectroscopy in diffuse reflectance mode (RD-IR), in which several absorption bands associated to Ca-O bonds were observed. In particular, a band located at 1795 cm⁻¹ increase in intensity in proportional form with the calcium content. This result is in agreement with EDX results. From these results, a correlation function between EDX and RD-IR was obtained, to evaluate in a practical form the calcium content.



Keywords: X-ray diffraction, clays, infrared spectroscopy

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X-ray characterization of the early Islamic reddish luster painted pottery

Sanae Miura¹, Norihiro Kato¹, Izumi Nakai¹, Yoko Shindo²

¹Tokyo University of Science, Science, 12-1 Ichigayafunagawaramachi Sinnjyuku-ku, Tokyo, Japan, Shinjyuku, Tokyo, 162-0826, Japan, ²Middle Eastern Culture Center, 3-10-31 Osawa, Mitaka-shi, Tokyo, 181-0015, Japan, E-mail: j1307691@ed.kagu.tus.ac.jp

‘Luster’ refers to iridescent decoration on glazed pottery, produced by metal pigments on white glaze, creating a metallic copper or

gold sheen. A characteristic of luster decoration is the presence of several colors (red, olive green or brown). In this study, chemical composition of glaze and luster pigment was analyzed by XRF analysis and chemical states of the metallic elements were by XAFS. We focused on the luster pottery with reddish colored decoration which was made in Iraq, especially 9th-10th centuries. Portable XRF spectrometer, OURSTEX100FAII was taken to Egypt. A total of 3,165 luster painted potteries made in Iraq were excavated in Raya till 2005, where is an archeological site in Sinai Peninsula, Egypt (Director, Dr. M. Kawatoko). Of these, 214 pieces were accompanied with reddish-colored luster. A classification of the glaze on these 214 pieces was performed by their chemical composition. Moreover, 79 pieces, which are stored in a museum in Japan, were also studied as well. In addition, XAFS analysis was carried out using synchrotron radiation at Photon Factory, Tsukuba, Japan. The white glaze of Iraq luster pottery can be classified into alkali-lime glaze and alkali-lead lime glaze. 1) Our XRF analysis showed that 67% of the Iraq luster painted pottery with reddish color excavated in Raya was alkali-lime glaze. This proportion is much higher than that of other colored luster potteries. XAFS analysis of the museum specimens revealed the relationship between the chemical state of copper and their color. An existence of metallic copper was found only in the luster painted pottery with reddish color, among various colored decorations. As a result, it can be said that strong reducing condition was necessary for the production of the reddish luster decoration.

Keywords: archaeology, EXAFS, ceramics

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Building of three dimensional Escher patterns by Layer-manufacturing

Yasunari Watanabe^{1,3}, Yuji Ikegami^{2,3}, Yoshiko Murakami¹,
Kenji Yamazawa², Teshima Yoshinori^{3,4}

¹Teikyoheisei University, Information Science, 2289-23 Uruido, Ichihara, Chiba, 290-0193, Japan, ²Institute of Physical and Chemical Research(RIKEN), 2-1Hirosawa, Wako, Saitama, 351-0198, Japan, ³Interdisciplinary Institute of Science Technology and Art(ISTA), 2-5-28Kitahara, Asaka, Saitama, 351-0036, Japan, ⁴National Institute of Advanced Industrial Science and Technology (AIST), 1-2 Namiki, Tsukuba, Ibaraki, 305-8564 Japan, E-mail: wistajp@yahoo.co.jp

Three-Dimensional Escher Patterns (3DES) are built by Layer-manufacturing. Two types of solid model are presented, whose original data are designed using CADPAC2 software. In the preparation of the model building an icosahedron is considered as a basic unit of modeling, which is an isotropic regular polyhedron with the maximum facet in the five regular-polyhedrons. Several inscribed cubes in the icosahedrons can be arranged such that they form cubic lattice decorated by set of icosahedrons. Assembled icosahedrons are formed to be 3D periodic structure with overlapped region of the icosahedrons inside and icosahedrons facet outside of the assembly (Icosahedrons assembly). External of icosahedron-assembly are much available for creating the object of motif such as a body of animal that has mirror symmetry. Model building of 3DES begins with the



deformation of unit cell of the cubic lattice by iterative arithmetic operation of CAD system. Iteration of CAD operation is carried out between the object space and the complimentary space. A creating process of the two animals is given and discusses the techniques of CAD system and an artistic sense of creator. 3DES is shown as follows.

Keywords: 3D Escher pattern, tiling art, layer manufacturing

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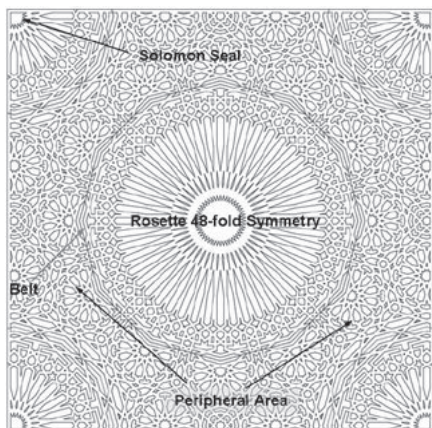
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Analysis of the craftsman's approach to moroccan geometric pattern

Abdelmalek Thalal¹, Jamal Benatia², Abdelaziz Jali³

¹University Cadi Ayyad - FSS - Marrakech, Physics, Bd du Prince My Abdellah, Marrakech, Morocco Kingdom, 40 000, Morocco, ²University Cadi Ayyad - FSS - Marrakech, Bd du Prince My Abdellah, Marrakech, Morocco Kingdom, 40 000, Morocco, ³University Cadi Ayyad - FSS - Marrakech, Bd du Prince My Abdellah, Marrakech, Morocco Kingdom, 40 000, Morocco, E-mail: athalal@menara.ma

Geometric patterns occur in rich profusion throughout Moroccan Ornaments. They are found on diversity of materials: tiles, wood, plaster, brass, ... The largest class of Moroccan patterns employs complex polygons. The unit cell is constituted of central area called Rosette, a peripheral area with the Solomon Seal at the corners, and an interface area or Belt between them (Fig1). Few of authors who have published the Islamic Patterns were interested in practise of the craftsman masters. The craftsman's approach to pattern making is an empirical method which consists in creating the design on graph paper using grids based on precise criteria of measurement called Hasba (module measure). Boundaries of the square or rectangular area, commonly used to create the design, must be defined accurately as well as the measure of the grids. Using the craftsmen's method, we utilize the computer to analyse and reproduce the Moroccan Patterns. The reconstruction is used to explore the geometrical structures of the patterns and also to extract the minimal information needed to generate the entire pattern only by the action of the symmetry transformations in the symmetry group of the pattern.



Keywords: symmetry group, Hasba, fundamental area

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Development of portable X-ray powder diffractometer and its application to archaeological artifacts

Yoshinari Abe¹, Izumi Nakai¹, Tantrakarn Kriengkamol¹, Maeo Shuji², Utaka Tadashi², Taniguchi Kazuo^{2,3}

¹Tokyo University of Science, Department of Applied Chemistry, Faculty of Science, Green Center Lab 1, 12th floor, Bldg. No.1, Tokyo University of Science, 1-3 Kagurazaka, Shinjuku-ku, Tokyo, 162-8601, Japan, ²Division of electronics and applied physics, Osaka Electro-Communication University, 18-8 Hatsu-cho, Neyagawa, Osaka 572-8530, Japan, ³Institute of X-ray Technologies Co. Ltd, Dia-3 Maruzen-Bldg. 3-5-21 Kigawahigashi, Yodogawa-ku, Osaka 532-0012, Japan, E-mail: j1307607@ed.kagu.tus.ac.jp

A new portable X-ray powder diffractometer suitable for on-site analyses of archaeological artifacts has been developed. The instrument is composed of a goniometer unit, a measurement-controller unit and a lap-top computer (Fig. 1). They can be stored in a portable trunk case and a total weight is 15 kg. We have adapted Cu as a target of X-ray tube and Si-Pin as detector, which enable us to obtain a good powder diffraction pattern with low background. A correct position of a sample is adjusted by using two laser pointers, which are useful for nondestructive analysis of a large sample. Additionally, this instrument has been improved to adapt a function of X-ray fluorescence spectrometer. With this modification, the instrument allowed us to carry out more reliable identification of unknown materials. The performance of the instrument was tested by measurements of standard materials. The results showed its high performance as both of X-ray powder diffractometer and X-ray fluorescence spectrometer. The instrument was brought to several archaeological sites in Egypt to verify the performance in field analysis and many archaeologically important results have been obtained.

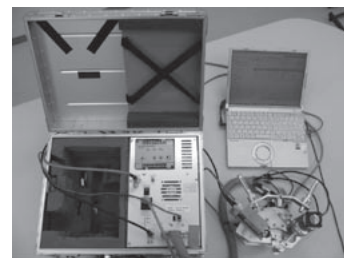


Fig. 1 An overview of the portable X-ray powder diffractometer.

Keywords: instrument development, nondestructive analysis, archaeology

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Implementing DDLm: Rewriting dREL algorithms into other languages

James R Hester

Bragg Institute, PMB 1, Menai, NSW, 2234, Australia, E-mail: jamesrhester@gmail.com

The most significant barrier to implementation of the new DDLm standard is finding a way to execute dREL algorithms. One possibility is to parse and rewrite the dREL algorithms into the language of choice. In addition to the parsing/rewriting engine, this implementation route requires both (i) definition of an execution environment, (ii) provision of libraries of mathematical and utility functions and (iii) automatic handling of error propagation. Defining the execution environment involves defining how to encode access to dictionary and data items in the rewritten algorithm, how to access library functions, and how the algorithm is called and return values received. A proof-of-concept program is presented which can convert