

anlog) were solved from laboratory diffractometer data. The results can be useful for the development of more potent and selective A2aAR antagonists which are important for the treatment of Morbus Parkinson. Complexity of the investigated compounds solved by global optimization technique [2] ranges from 22 to 46 atoms in an asymmetric unit. Powder diffraction data were recorded both using Bragg-Brentano and DSH geometry (to reduce texture). It was astonishing that in the case of very strong texture one can encounter problems even in the indexing procedure. In such cases crystal structure solution process from powder data verifies the indexing and space group determination results.

[1] Muller C.E., Sauer R., Geis U., Frobenius W., Talik P., Pawłowski M., *Arch. Pharm. Pharm. Med. Chem.*, 1997, **330**, 181-189. [2] Favre-Nicolin V., Cerny R., *J. Appl. Cryst.*, 2002, **35**, 734.

**Keywords:** powder structure determination, pharmaceuticals, preferred orientation

#### P.02.12.1

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#### Preparation and Crystal Structure of Tetraperoxo Complexes of Molybdenum (VI) and Vanadium (V)

Maciej Grzywa, Wiesław Łasocha, *Faculty of Chemistry, Jagiellonian University, ul. Indarżna 3, 30-060 Kraków, Poland.* E-mail: grzywa@chemia.uj.edu.pl

Molybdenum and vanadium peroxo complexes have been widely investigated due to their potent catalytic properties in various reactions important for industry and environment. Peroxovanadium compounds have potent biochemical effects (effective insulin mimics, antitumor activity in mice).

In the poster we will present the crystal structures of potassium tetraperoxomolybdate (VI)  $K_2[Mo(O_2)_4]$ , caesium tetraperoxomolybdate (VI)  $Cs_2[Mo(O_2)_4]$  and lithium tetraperoxovanadate (V)  $Li_3[V(O_2)_4]$ .

The lattice parameters and space group were determined using PROSZKI package [1]. Structure models were built by using the global optimisation method (FOX program [2]) and refined by the Rietveld method (DBWS [3] and XRS-82 [4] programs).

[1] Łasocha W., Lewiński K., *J. Appl. Crystallogr.*, 1994, **27**, 437. [2] Favre-Nicolin V., Cerny R., *J. Appl. Cryst.*, 2002, **35**, 734. [3] Young R. A., Sakthivel A., Moss T. S., Paiva-Santos C. O., *J. Appl. Crystallogr.*, 1995, **28**, 366. [4] Baerlocher Ch., Hepp A., McCusker L. B., *XRS -82*, The X-ray Rietveld System of Crystallographic Programs for Powder Data, Zurich, 1982.

**Keywords:** peroxocomplexes, powder diffraction, Rietveld refinement

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#### Space Group Determination by EXPO2005

Corrado Cuocci<sup>a</sup>, Anna Grazia Moliterni<sup>b</sup>, Angela Altomare<sup>b</sup>, Iván da Silva<sup>c</sup>, Rocco Caliandro<sup>b</sup>, Mercedes Camalli<sup>d</sup>, Carmelo Giacovazzo<sup>a,b</sup>, Rosanna Rizzi<sup>b</sup>, <sup>a</sup>*Dip. Geomin., University of Bari, Italy.* <sup>b</sup>*IC-CNR, Bari, Italy.* <sup>c</sup>*Dip. Física Fundamental II, Universidad de La Laguna, Tenerife, Spain.* <sup>d</sup>*IC-CNR, Sezione di Monterotondo, Italy.* E-mail: corrado.cuocci@ic.cnr.it

The preliminary step to solve crystal structure is the determination of the space group. In case of powder diffraction data the peak overlap makes difficult the recognition of systematically absent reflections and therefore the extinction symbol identification. We have developed a new approach [1] based on the statistical analysis of the normalized intensities extracted by Le Bail method from the diffraction pattern. In order to improve the results new algorithms have been carried out regarding:

- the removal of impurity peaks;
- the background level determination;
- the variance associated to integrated intensity estimated;
- the selection of reflections relevant for the extinction group recognition;
- the graphic interface improvement

The new approach has been implemented in EXPO2005, the

evolution of EXPO2004 [2], and has been successfully tested using a large set of experimental data.

[1] Altomare A., Caliandro R., Camalli M., Cuocci C., da Silva I., Giacovazzo C., Moliterni A.G.G., Spagna R., *J. Appl. Cryst.*, 2004, **37**, 957-966. [2] Altomare A., Caliandro R., Camalli M., Cuocci C., Giacovazzo C., Moliterni A.G.G., Rizzi R., *J. Appl. Cryst.*, 2004, **37**, 1025-1028.

**Keywords:** space groups, powder diffraction, computing in crystallography

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#### Structures in Mo-Ru-Si System by Powder and Anomal X-ray Diffraction

Michel François<sup>a</sup>, Michel Vilasi<sup>a</sup>, Eric Elkaim<sup>b</sup>, Ferhaht Zamoum<sup>a</sup>, <sup>a</sup>*LCSM, University H.Poincaré, Nancy, France.* <sup>b</sup>*Synchrotron Soleil, GIF-sur-Yvette, France.* E-mail: francois.michel@lcsm.uhp-nancy.fr

MoSi<sub>2</sub> attracted extensive interest during the last years because of its great potential for new high temperature structural materials. In order to improve MoSi<sub>2</sub> performance against "pest" phenomenon and glass corrosion at 1350°C additions of ruthenium metals have been made. This original way led us to investigate the Mo-Ru-Si ternary system that revealed the existence of five new phases noted  $\alpha$  (Mo<sub>15</sub>Ru<sub>35</sub>Si<sub>50</sub>),  $\beta$  (Mo<sub>26</sub>Ru<sub>47</sub>Si<sub>27</sub>),  $\gamma$  (Mo<sub>41</sub>Ru<sub>41</sub>Si<sub>18</sub>),  $\delta$  (Mo<sub>15</sub>Ru<sub>50</sub>Si<sub>35</sub>), and  $\sigma$  (Mo<sub>60</sub>Ru<sub>30</sub>Si<sub>30</sub>). The phases  $\alpha$  and  $\sigma$  are isotypes of the FeSi and FeCr structures respectively. The structures of the  $\beta$  and  $\gamma$  phases were determined ab-initio from synchrotron X-ray powder diffraction (XRPD) data. All of these phases are partially disorder with statistical occupancy of sites by the various metallic atoms. In order to increase the contrast between Mo and Ru and to obtain a crystallographic composition, X-Ray powder patterns were performed at the Mo-K threshold (20 keV) so as to use the anomalous effect. Therefore, multi refinement pattern using two wave lengths (one near the Mo Threshold, the other out) has been performed. Subsequently, an assessment of the site occupancy rates allowed to specify the distribution of the Mo ( $Z = 42$ ) and Ru ( $Z = 44$ ) atoms. Extension of the stability domain of  $\beta$  phase Mo<sub>4+x</sub>Ru<sub>9-x</sub>Si<sub>5</sub> ( $0 \leq x \leq 1$ ) is understood on the basis of the XRPD results and electronic properties calculation (KKR method) as a function of the composition [1].

[1] Littner A., François M., Tobola J., Elkaim E., Malaman B., Vilasi M., *Intermetallics*, 2005, in press.

**Keywords:** high melting systems, ab-initio powder structure determination, anomalous diffraction

#### P.02.12.4

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#### Algorithms for Solving Crystal Structure using Texture

Luca Lutterotti, Mauro Bortolotti, *Department of Materials Engineering and Industrial Technologies, University of Trento.* E-mail: Luca.Lutterotti@ing.unitn.it

Texture is generally considered a nightmare for crystal structure solving or refinement. Wessels et al. [1] have demonstrated as texture can be used successfully to help the extraction of reliable structure factors from powder data to employ single crystal like structure solution methods.

The methodology has been extended a little further and some new algorithms will be presented to simplify the procedure in a unique improved step. Using an approach derived from Rietveld Texture Analysis [2] the simultaneous texture determination and structure factors extraction can be done. This was possible by introducing a new texture algorithm (EWIMV) and a texture aware extraction algorithm to combine the two procedures. By this method it is possible to extract structure factors from really highly overlapped pattern and use only one single experiment. An alternative method uses instead a Maximum Entropy Electron Map fitting approach to apply some constraints to the structure factors extraction.

The algorithms were implemented in the software Maud [3] along with other ab-initio structure solution routines for peak finding and indexing (through evolutionary algorithms), space group sorting and refinement constraints (energy computation, fragments etc.). Some