## **Volume III/7: Crystal Structure Data of Inorganic Compounds**

Editors: K.-H. Hellwege and A.M. Hellwege

Authors: W. Pies, A. Weiss. In cooperation with H.-P. Boehm, H.J. Meyer (c3); G. Will (d1 $\alpha$ ); G. Pieper (d1 $\beta$ ); R. Allmann (d2)

## Part c2: Key Elements: P, As, Sb, Bi

1979. 14 figs., XXVII, 452 pages. ISBN 3-540-09039-8

## **Contents**

| Introduction  1 Subject matter  2 Arrangement of the substances Survey: Distribution of substances within subvolumes III/7a III/7h  3 Selection and arrangement of information in the tables 3.1 Selection of information 3.2 Arrangement of information 3.3 Reference sources  4 References used in the introduction  5 List of space-group symbols for various settings  6 List of symbols and abbreviations  | XIII XIII XIII XIII XIV XVII XVIII XVIII XXIII XXIII XXXV see volume III/7a, page XXIV XXVI |
|---|---|
| Tables VII Compounds with the key element phosphorus VII.1 Phosphorus hydride and derivatives including phosphides VII.1.1 Phosphorus hydride and hydrogen phosphides VII.1.2 Phosphides VII.1.2.1 Binary and temary phosphides VII.1.2.2 Phosphides with additional anions VII.1.2.2.1 Phosphideswith Cl <sup>-</sup> , Br <sup>-</sup> , I <sup>-</sup> VII.1.2.2.2 Phosphides with sulfur (thiophosphides) VII.1.2.2.3 Phosphides with selenium (selenophosphides)   | 1<br>1<br>1<br>61<br>61<br>63<br>68   |
| VII.1.2.2.4 Phosphides with tellurium (tellurophosphides) VII.1.2.2.5 Phosphides with nitrogen (nitridephosphides) VII.2 Oxo-compounds of phosphorus VII.2.1 Oxidephosphides VII.2.2 Hypophosphites VII.2.2.1 Anhydrous hypophosphites  | 71<br>71<br>72<br>72<br>72<br>72  |
| VII.2.2.2 Hypophosphites with H <sub>2</sub> O VII.2.3 Phosphites VII.2.3.1 Anhydrous phosphites VII.2.3.2 Phosphites with H <sub>2</sub> O VII.2.4 Hypodiphosphates VII.2.4.1 Anhydrous hypodiphosphates VII.2.4.2 Hypodiphosphates with H <sub>2</sub> O VII.3 Phosphates polyphosphates and pyrophosphates   | 73<br>74<br>74<br>76<br>78<br>78<br>78<br>78  |
| <ul> <li>VII.3 Phosphates, polyphosphates, and pyrophosphates</li> <li>VII.3.1 Anhydrous phosphates</li> <li>VII.3.2 Phosphates with H<sub>2</sub>O</li> <li>VII.3.3 Phosphates with additional anions</li> <li>VII.3.3.1 Phosphates with halide ions as additional anions</li> <li>VII.3.3.1.1 Phosphates with F<sup>-</sup> as additional anion</li> <li>VII.3.3.1.2 Phosphates with Cl<sup>-</sup> as additional anion</li> <li>VII.3.3.1.3 Phosphates with Br<sup>-</sup> and I<sup>-</sup> as additional anions</li> </ul> | 79<br>79<br>194<br>229<br>229<br>229<br>239<br>245  |
| VII.3.3.1.3 Phosphates with Br and T as additional anions VII.3.3.1.4 Phosphates with halide ions as additional anions and H <sub>2</sub> O VII.3.3.2 Phosphates with OH <sup>-</sup> as additional anion VII.3.3.2.1 Anhydrous phosphates with OH <sup>-</sup> as additional anion and H <sub>2</sub> O VII.3.3.2.2 Phosphates with OH <sup>-</sup> and halide ions as additional anions   | 243<br>246<br>247<br>247<br>263<br>277  |

| VII.3.3.2.4 Phosphates with OH <sup>-</sup> and halide ions as additional anions and H <sub>2</sub> O VII.3.3.2.5 Phosphates with OH <sup>-</sup> and O <sup>-</sup> <sub>2</sub> , O <sup>2-</sup> as additional anions | 280<br>281 |
|--|------------|
| VII.3.3.3 Phosphates with SO <sup>2</sup> - <sub>4</sub> , SeO <sup>2</sup> - <sub>4</sub> , NO <sub>3</sub> as additional anions  | 282        |
| VII.3.3.3.1 Anhydrous phosphates with SO <sup>2</sup> -4, SeO <sup>2</sup> -4, NO <sup>3</sup> as additional anions  | 282        |
| VII.3.3.3.2 Phosphates with $SO^{2-}_{4}$ , $SeO^{2-}_{4}$ , $NO^{-}_{3}$ as additional anions and $H_{2}O$  | 287        |
| VII.3.4 Substituted phosphates   | 288        |
| VII.3.4.1 Halogenophosphates   | 288        |
| VII.3.4.1 Phosphates substituted with fluorine and chlorine  | 288        |
| VII.3.4.1.1 Phosphates substituted with fluorine and chlorine with H <sub>2</sub> O  | 289        |
|  | 290        |
| VII.3.4.2 Thio- and selenophosphates VII.3.4.2.1 Thiophosphates  |            |
|  | 290<br>294 |
| VII.3.4.2.2 Selenophosphates   |            |
| VII.3.4.2.3 Thio- and selenophosphates with H <sub>2</sub> O   | 295        |
| VII.3.4.3 Phosphates substituted with NH <sub>2</sub> (amidophosphates and amidothiophosphates) VII.3.5 Cyclic compounds with P, N, S, halogen   | 296<br>297 |
| VIII Compounds with the key elements arsenic, antimony, and bismuth  | 306        |
| VIII.1 Compounds with the key element arsenic  | 306        |
| VIII.1.1 Arsenides   | 306        |
| VIII.1.1.1 Arsenides with additional anions  | 306        |
| VIII.1.1.1 Nitride- and phosphide-arsenides  | 306        |
| VIII.1.1.1.2 Halide-arsenides  | 310        |
| VIII.1.1.2.1 Arsenides with Cl   | 310        |
| VIII.1.1.1.2.2 Arsenides with Br and I   | 311        |
| VIII.1.2 Oxo-compounds of arsenic  | 313        |
| VIII.1.2.1 Anhydrous oxo-compounds of arsenic  | 313        |
| VIII.1.2.2 Oxo-compounds of arsenic with H <sub>2</sub> O  | 345        |
| VIII.1.2.3 Oxo-compounds of arsenic with additional anions   | 365        |
| VIII.1.2.3.1 Oxo-compounds of arsenic with F as additional anion   | 365        |
| VIII.1.2.3.2 Oxo-compounds of arsenic with Cl <sup>-</sup> as additional anion   | 366        |
| VIII.1.2.3.3 Oxo-compounds of arsenic with Br and I as additional anions   | 368        |
| VIII.1.2.3.4 Oxo-compounds of arsenic with OH as additional anion  | 370        |
| VIII.1.2.3.5 Oxo-compounds of arsenic with SO <sup>2-</sup> <sub>4</sub> , PO <sup>3-</sup> <sub>4</sub> , as additional anions  | 377        |
| VIII.1.2.3.6 Oxo-compounds of arsenic with additional anions and H <sub>2</sub> O  | 382        |
| VIII.1.2.3.6.1 Oxo-compounds of arsenic with halide ions and H <sub>2</sub> O  | 382        |
| VIII.1.2.3.6.2 Oxo-compounds of arsenic with OH <sup>-</sup> and H <sub>2</sub> O  | 383        |
| VIII.1.2.3.6.3 Oxo-compounds of arsenic with SO <sup>2</sup> - <sub>4</sub> , PO <sup>3</sup> - <sub>4</sub> , and H <sub>2</sub> O  | 389        |
| VIII.1.2.4 Substituted arsenates   | 391        |
| VIII.1.2.4.1 Fluoroarsenates   | 391        |
| VIII.1.2.4.2 Fluoroarsenates with H <sub>2</sub> O   | 392        |
| VIII.1.2.4.3 Hydroxoarsenates  | 392        |
| VIII.1.2.4.4 Thioarsenates   | 393        |
| VIII.2 Compounds with the key element antimony   | 394        |
| VIII.2.1 Antimonides   | 394        |
| VIII.2.1.1 Antimonides with Br and I as additional anions  | 394        |
| VIII.2.2 Oxo-compounds of antimony   | 395        |
| VIII.2.2.1 Anhydrous oxo-compounds of antimony   | 395        |
| VIII.2.2.2 Oxo-compounds of antimony with H <sub>2</sub> O   | 433        |
| VIII.2.2.3 Oxo-compounds of antimony with additional anions  | 434        |
| VIII.2.2.3.1 Oxo-compounds of antimony with F as additional anion  | 434        |
| VIII.2.2.3.2 Oxo-compounds of antimony with OH and F as additional anions  | 436        |
| VIII.2.2.3.2.1 Anhydrous oxo-compounds of antimony with OH and F as additional anions  | 436        |
| VIII.2.2.3.2.2 Oxo-compounds of antimony with OH and F as additional anions and H <sub>2</sub> O,  |            |
| NH <sub>3</sub>  | 438        |
| VIII.2.2.4 Thio-compounds of antimony  | 440        |
| VIII.3 Compounds with the key element bismuth  | 441        |
| VIII.3.1 Bismuthides   | 441        |
| VIII.3.2 Oxo-compounds of bismuth  | 442        |