

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

INORGANIC CHEMISTRY DIVISION

## **NAME AND SYMBOL OF THE ELEMENT WITH ATOMIC NUMBER 110**

**(IUPAC Recommendations 2003)**

*Prepared for publication by*  
J. CORISH<sup>1,‡</sup> AND G. M. ROSENBLATT<sup>2</sup>

<sup>1</sup>*University of Dublin, Chemistry Department, Trinity College, Dublin 2, Ireland;* <sup>2</sup>*Lawrence Berkeley National Laboratory, Materials Sciences Division, Building 62, Room 203, University of California, Berkeley, CA 94720, USA*

<sup>‡</sup>Corresponding author

---

*Republication or reproduction of this report or its storage and/or dissemination by electronic means is permitted without the need for formal IUPAC permission on condition that an acknowledgment, with full reference to the source, along with use of the copyright symbol ©, the name IUPAC, and the year of publication, are prominently visible. Publication of a translation into another language is subject to the additional condition of prior approval from the relevant IUPAC National Adhering Organization.*

# Name and symbol of the element with atomic number 110

## (IUPAC Recommendations 2003)

*Abstract:* A joint IUPAC–IUPAP Working Party (JWP) confirmed the discovery of the element with atomic number 110. In accord with IUPAC procedures, the discoverers proposed a name and symbol for the element. The Inorganic Chemistry Division recommended this proposal for acceptance, and it was adopted by the IUPAC Council at Ottawa, 16 August 2003. The recommended name is darmstadtium with symbol Ds.

### INTRODUCTION

In 1998, a joint Working Party (JWP) comprised of four independent experts from IUPAC and IUPAP was established to determine priority of claims for the discovery of elements with atomic numbers 110, 111, and 112. The JWP used the criteria established in 1992 by the IUPAC–IUPAP Transfermium Working Group [1–3] in considering documentation solicited from and submitted by claimant laboratories. The JWP published its report in 2001 [4]. Prior to its publication, the report was sent to each of the claimant laboratories to be checked for technical accuracy. It was also reviewed by eight independent expert referees. The findings of the 2001 JWP report were accepted by both Unions.

### RECOMMENDATION

The 2001 JWP report concluded that the criteria for discovery of an element had been fulfilled only in the case of the element with atomic number 110 and this by the collaboration of Hofmann et al. [5]. Following this assignment and in accordance with the procedures established by IUPAC for the naming of elements [6], the discoverers [7] at the Gesellschaft für Schwerionenforschung mbH (GSI) in Darmstadt, Germany were invited to propose a name and symbol for the element with atomic number 110\*. The discoverers proposed the name darmstadtium and the symbol Ds.

This proposal lies within the long established tradition of naming an element after the place of its discovery. The Division Committee of the Inorganic Chemistry Division considered the proposal and recommended to the IUPAC Bureau and Council that the name darmstadtium and symbol Ds for the element with atomic number 110 be accepted. Provisional recommendations of the name and symbol were made available in January 2003. The final recommendations were approved by the IUPAC Council in Ottawa, Canada on 16 August 2003.

---

\*The element with atomic number 110 under the IUPAC systematic (provisional) naming system was referred to as ununnilium, symbol Uun, prior to this recommendation.

## REFERENCES AND NOTES

1. D. H. Wilkinson, A. H. Wapstra, I. Uhelea, R. C. Barber, N. N. Greenwood, A. Hrynkiewicz, Y. P. Jeannin, M. Lefort, M. Sakai. "Criteria that must be satisfied for the discovery of a new chemical element to be recognised", *Pure Appl. Chem.* **63**, 879–886 (1991).
2. D. H. Wilkinson, A. H. Wapstra, I. Uhelea, R. C. Barber, N. N. Greenwood, A. Hrynkiewicz, Y. P. Jeannin, M. Lefort, M. Sakai. "Discovery of the transfermium elements. Part II: Introduction to the discovery profiles", *Pure Appl. Chem.* **65**, 1757–1763 (1993).
3. D. H. Wilkinson, A. H. Wapstra, I. Uhelea, R. C. Barber, N. N. Greenwood, A. Hrynkiewicz, Y. P. Jeannin, M. Lefort, M. Sakai. "Discovery of the transfermium elements. Part III: Discovery profiles of the transfermium elements", *Pure Appl. Chem.* **65**, 1764–1814 (1993).
4. P. J. Karol, H. Nakahara, B. W. Petley, E. Vogt. "On the discovery of elements 110–112", *Pure Appl. Chem.* **73**, 959–967 (2001).
5. S. Hofmann, V. Ninov, F. P. Hessberger, P. Armbruster, H. Folger, G. Munzenberg, H. J. Schott, A. G. Popeko, A. V. Yeremin, A. N. Andreyev, S. Saro, R. Janik, M. Leino. "Production and decay of  $^{269}110$ ", *Z. Phys A* **350**, 277–280 (1995).
6. W. H. Koppenol. "Naming of new elements", *Pure Appl. Chem.* **74**, 787–791 (2002).
7. Since publication of its 2001 report, the IUPAC–IUPAP JWP has continued examination of the potential discovery of elements with atomic numbers equal to or greater than 110. In its forthcoming report [P. J. Karol, H. Nakahara, B. W. Petley, E. Vogt. "On the claims for discovery of elements 110, 111, 112, 114, 116, and 118", *Pure Appl. Chem.* **75**, 1601–1611 (2003)], the JWP reendorses the confirmed synthesis of element 110 by the team at GSI led by S. Hofmann (after reassessment necessitated by revelations at the Berkeley and GSI laboratories of some apparently fabricated or partially modified decay chains). Additionally, the GSI team's production of isotope  $^{271}110$  has been reproduced and confirmed at two independent laboratories, the E. O. Lawrence Berkeley National Laboratory of the University of California (LBNL), USA. [T. N. Ginter, C. M. Folden III, K. E. Gregorich, D. C. Hoffman, U. W. Kirbach, D. M. Lee, W. Loveland, V. Ninov, H. Nitsche, J. B. Patin, N. Seward, R. Sudowe, P. A. Wilk, P. M. Zielinski, K. Aleklett, R. Eichler. "Confirmation of production of element 110 by the  $^{208}\text{Pb}(^{64}\text{Ni},n)$  reaction", *Phys. Rev. C* **67**, 064609 (2003)] and the Institute of Physical and Chemical Research (RIKEN), Wako, Saitama, Japan [K. Morita, K. Morimoto, D. Kaji, A. Yoneda, A. Yoshida, T. Suda, E. Ideguchi, T. Ohnishi, Y. L. Zhao, M. Xu, T. Zheng, H. Haba, H. Kudo, K. Sueki, A. Ozawa, F. Tokanai, H. Koura, R. Kanungo, K. Katori, I. Tanihata. "Confirmation of the synthesis of isotope  $^{271}110$  of the element 110", *RIKEN Accelerator Prog. Rep.* **36**, 90–91 (2002); also *Eur. Phys. J. A*, to be published].