American Chemical Society

National Awards Nomination Packet

Glenn T. Seaborg Award for Nuclear Chemistry:2018
for: Thomas Albrecht-Schmitt

Received: 10/28/2015 *Cycle Year: 2*

"For his work showing the first strong links between d transition metal and 5f-element chemistry"

NOMINATOR:

Kenneth Raymond

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529 Latimer Hall
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UNITED STATES

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Fax: (510)642-5324
Email: raymond@socrates.berkeley.eduXXX

- Have you discussed this award nomination with the nominee? *Yes*

NOMINEE:

Thomas Albrecht-Schmitt

Florida State University
95 Chieftan Way
Tallahassee, FL 32306-0001
UNITED STATES

Tel: (850)645-0477
Email: talbrechtschmitt@gmail.comXXX

ACS Current Member: Yes
Years of Service: 24
Date of birth: 01/01/1971
Present Position: Gregory R. Choppin Professor
Industry: Academia

SAFETY PROTOCOLS:

- Does the nominee employ and require good safety protocols and practices in his/her laboratory? *Yes*

SUPPORTER 1

David Clark

900 Canyon Rd
Los Alamos, NM 87544-2928
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SUPPORTER 2

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September 8, 2015

American Chemical Society
Award Selection Committee
1155 Sixteenth Street, NW
Washington, DC 20036

Dear Award Selection Committee:

I write to nominate Professor Thomas E. Albrecht-Schmitt for the 2016 Glenn T. Seaborg Award for Nuclear Chemistry. Thomas Albrecht-Schmitt has emerged as the academic leader in nuclear chemistry for this generation. As will be described, his work has opened entirely new veins in what had been thought to be a worked out mine. I knew Glenn Seaborg as a colleague. Even very late in his career, after many extremely high level administrative appointments, Glenn Seaborg routinely attended research seminars and showed an active interest in actinide chemistry (a name of course attributed to Seaborg himself). Seaborg would have been thrilled with the recent work that Albrecht-Schmitt has published. As such he strongly deserves the Glenn T. Seaborg Award.

I know the work of Albrecht-Schmitt well. He is an outstanding actinide chemist at a time when this has been a vanishing breed. However the dramatic changes in this field, especially the ability to carry out theoretical studies on the electronic structure on these 5f element compounds, has produced something of a renaissance of this field and Albrecht-Schmitt is its top academic leader in his age cohort. [I will refer to publications as they are numbered in the attached list.] His work on the differentiation of uranium and neptunium and uranium and the other actinides has been very important for the fundamental aqueous chemistry. I point in particular to his paper that follows the oxidation of water by Np(VI) (publication 9).

Professor Albrecht-Schmitt has continued his important list of publication triumphs in new areas of chemistry. He is one of the pioneers in the solid state chemistry of the actinides. He has also played a major role in technetium chemistry, critical in one isotope for clinical imaging and as the longer lived isotope as one of the major problems associated with nuclear waste storage. His publication number 13 in *Advanced Functional Materials* received a great deal of attention even before the print version had appeared.

Albrecht-Schmitt is an excellent speaker and a first class teacher. He gives high quality seminars and lectures. His training in crystallography at the hands of Professor Ibers was first rate and this also began his interest in solid state chemistry. However his interest in actinide chemistry was mostly self-taught and it is a tribute to his persistence and tenacity that he has made such progress. This area of research, because of the radiological hazards involved and the limited number of places prepared to carry out the research, is more of a challenge than easier areas of chemistry.

The participation of the valence orbitals of actinides in bonding has been a research question since the discovery of these elements. Recent experimental and computational investigations have shown the involvement of 6*p*, 6*d* and/or 5*f* orbitals in bonding. Albrecht-Schmitt has interpreted structural and spectroscopic data, as well as theory, as showing a decrease in covalency across the actinide series, and highly ionic, lanthanide-like bonding for late actinides. In a Nature paper published this year (publication 20) Albrecht-Schmitt and coauthors showed that chemical differentiation between californium and lanthanides can be achieved by using ligands that are both highly polarizable and substantially rearrange on complexation, particularly by a ligand called polyborate. They demonstrated that the 5*f*, 6*d* and 7*p* orbitals are all involved in bonding in a Cf(III) borate, and that large crystal-field effects are present. Synthetic, structural and spectroscopic data as well as quantum mechanical calculations all supported this interpretation.

As I hope this letter and supporting letters demonstrate, Thomas Albrecht-Schmitt deserves the Glenn T. Seaborg Award for Nuclear Chemistry for his work showing the first strong links between d transition metal and 5f-element chemistry.

Sincerely,

Kenneth N. Raymond
Chancellor's Professor

KNR:scm

THOMAS E. ALBRECHT-SCHMITT
Biosketch

DATE AND PLACE OF BIRTH September 5, 1971; Hershey, PA USA

CONTACT INFORMATION

Department of Chemistry and Biochemistry
Florida State University
95 Chieftan Way
Tallahassee, FL 32306-4390
Email: albrecht-schmitt@chem.fsu.edu
Cell phone: 850-841-9525

ACADEMIC TRAINING

B.S. Southwest State University, Marshall, MN, 1993
M.S. Northwestern University, Evanston, IL, 1994
Ph.D. Northwestern University, Evanston, IL, 1997 (Mentor: James A. Ibers)
Post-Doctoral Associate, University of Illinois, 1997-1998 (Advisor: John R. Shapley)

ACADEMIC POSITIONS

Assistant Professor, Auburn University, 9/98-8/02
Associate Professor, Auburn University, 8/02-8/07
Professor, Auburn University, 8/07-12/08
Professor, University of Notre Dame, 1/09-8/12
Gregory R. Choppin Chair in Chemistry, Florida State University, 8/12-current
Condensed Matter Sciences Affiliate, National High Magnetic Field Lab, 8/13-current

RESEARCH INTERESTS

Synthetic, structural, and environmental actinide chemistry, radiochemistry, lanthanide chemistry, solid-state chemistry, magnetism, crystal growth, X-ray diffraction, ion-exchange materials, nonlinear optical materials, thermoelectric materials, structure-property relationships, nuclear energy

HONORS AS A PROFESSOR

Dean's Research Award, Auburn University, College of Science and Mathematics, 2005
Editorial Board of the Journal of Solid State Chemistry, 2005-2013
Alumni Sigma Xi Research Award, 2005
Phi Eta Sigma National Honor Society's Service Excellence Award, 2014
Fellow of the Royal Society of Chemistry, 2015
Guest Professor, Suzhou University, 2015-current
ACS, Nobel Laureate Signature Award for Graduate Education in Chemistry, 2016

SERVICE TO THE AMERICAN CHEMICAL SOCIETY

Chair-elect for the Auburn section of the American Chemical Society, 1999-2000
Chair, Auburn section of American Chemical Society, 2000-2001

Executive Committee, Member-at-Large, American Chemical Society, Inorganic Division, 2009-2011

Memberships in Significant Professional Organizations

Royal Society of Chemistry (United Kingdom)
American Chemical Society (Inorganic and Nuclear Divisions)
Phi Lambda Upsilon
Sigma Xi
Materials Research Society
American Association for the Advancement of Science
American Nuclear Society

THOMAS E. ALBRECHT-SCHMITT
Top 20 Publications

20. S. K. Cary, M. Vasiliu, R. E. Baumbach, J. T. Stritzinger, T. D. Green, K. Diefenbach, J. N. Cross, K. L. Knappenberger, G. Liu, M. A. Silver, A. E. DePrince III, S. M. Van Cleve, J. H. House, N. Kikugawa, A. Gallagher, A. A. Arico, D. A. Dixon, T. E. Albrecht-Schmitt, "Emergence of Californium as the Second Transitional Element in the Actinide Series," *Nature Communications*, **2015**, *6*, 6827-34. **DOI:** 10.1038/ncomms7827. *Went viral. Featured on many website including Newsweek. Featured in C&EN News.* ***Contacted by the White House because of this work.***
19. M. A. Silver, W. L. Dorfner, J. N. Cross, S. K. Cary, J. Lin, E. J. Schelter, T. E. Albrecht-Schmitt, "Why is Uranyl Formohydroxamate Red?" *Inorganic Chemistry* **2015**, *54*, 5280-5284. *Selected for Editors' Choice Article and Featured on Website.* **DOI:** 10.1021/acs.inorgchem.5b00262
18. G. Liu, S. K. Cary, T. E. Albrecht-Schmitt, "Metastable Charge-Transfer State of Californium(III) Compounds," *Physical Chemistry Chemical Physics*, **2015**, *17*, 16151-16157. DOI: 10.1039/c5cp01855b
17. M. J. Polinski, E. B. Garner III, R. Maurice, N. Planas, J. T. Stritzinger, T. G. Parker, T. D. Green, E. V. Alekseev, S. M. Van Cleve, W. Depmeier, L. Gagliardi, M. Shatruk, K. L. Knappenberger, G. Liu, S. Skanthakumar, L. Soderholm, D. A. Dixon, T. E. Albrecht-Schmitt, "Unusual Structure, Properties, and Bonding in a Californium Borate," *Nature Chemistry*, **2014**, *6*, 387-392. **DOI:** 10.1038/nchem.1896 **Cover** ***Article.*** *Went Viral: Featured in* ***Chemistry World, C&EN News, Time, New York Times, Materials Research Society***, ***National Public Radio****, etc.* **Over 130,000 hits in a week.** ***Selected as the top chemistry discovery of 2014 by the Royal Society of Chemistry.***
16. J. N. Cross, E. M. Villa, V. R. Darling, M. J. Polinski, J. Lin, X. Tan, N. Kikugawa, M. Shatruk, R. Baumbach, T. E. Albrecht-Schmitt, "Straightforward Reductive Routes to Air-Stable Uranium(III) and Neptunium(III) Materials," *Inorganic Chemistry*, **2014**, *53*, 7455-7466. **DOI:** 10.1021/ic500771t
15. J. N. Cross, P. M. Duncan, E. M. Villa, M. J. Polinski, J.-M. Babo, E. V. Alekseev, C. H. Booth, T. E. Albrecht-Schmitt, "From Yellow to Black: Dramatic changes between Ce(IV) and Pu(IV) Molybdates," *Journal of the American Chemical Society*, **2013**, *135*, 2769-2775.
14. M. J. Polinski, D. J. Grant, S. Wang, E. V. Alekseev, J. N. Cross, E. M. Villa,W. Depmeier, L. Gagliardi, T. E. Albrecht-Schmitt, "Differentiating between Trivalent Lanthanides and Actinides," *Journal of the American Chemical Society*, **2012**, *134*, 10682-10692.
13. S. Wang, P. Yu, B. A. Purse, M. J. Orta, J. Diwu, W. H. Casey, B. L. Phillips, E. V. Alekseev, W. Depmeier, D. T. Hobbs, T. E. Albrecht-Schmitt, "Selectivity, Kinetics, and Efficiency of Reversible Anion Exchange with TcO_4^- in a Supertetrahedral Cationic Framework," *Advanced Functional Materials*, **2012**, *22*, 2241-2250.
12. M. J. Polinski, S. Wang, E. V. Alekseev, W. Depmeier, G. Liu, R. G. Haire, T. E. Albrecht-Schmitt, "Curium(III) Borate Reveals Coordination Environments of both Plutonium(III) and Americium(III) Borates," *Angewandte Chemie*, *Int. Ed.*, **2012**, *51*, 1869-1872.

11. S. Wang, J. Diwu, A. Simonetti, C. H. Booth, T. E. Albrecht-Schmitt, "Interstitial Incorporation of Plutonium into a Low-Dimensional Potassium Borate," *Environmental Science & Technology*, **2011**, *45*, 9457-9463.
10. M. J. Polinski, S. Wang, E. V. Alekseev, W. Depmeier, T. E. Albrecht-Schmitt, "Bonding Changes in Plutonium(III) and Americium(III) Borates," *Angewandte Chemie*, *Int. Ed.*, **2011**, *50*, 8891-8894.
9. S. Wang, E. M. Villa, J. Diwu, E. V. Alekseev, W. Depmeier, T. E. Albrecht-Schmitt, "Role of Anions and Reaction Conditions in the Preparation of Uranium(VI), Neptunium(VI), and Plutonium(VI) Borates," *Inorganic Chemistry*, **2011**, *50*, 2527-2533.
8. P. Yu, S. Wang, E. V. Alekseev, W. Depmeier, T. E. Albrecht-Schmitt, B. L. Phillips, W. H. Casey, "^{99}Tc-MAS-NMR on a Cationic Framework Material for Trapping TcO_4^-," *Angewandte Chemie*, *Int. Ed.*, **2010**, *49*, 5975-5977.
7. 4. S. Wang, E. V. Alekseev, J. Ling, G. Liu, W. Depmeier, T. E. Albrecht-Schmitt, "Polarity and Chirality in Uranyl Borates: Insights into Understanding the Vitrification of Nuclear Waste and the Development of Nonlinear Optical Materials," *Chemistry of Materials*, **2010**, *22*, 2155-2163.
6. S. Wang, E. V. Alekseev, J. Diwu, W. H. Casey, B. L. Phillips, W. Depmeier, T. E. Albrecht-Schmitt, "NDTB-1: A Supertetrahedral Cationic Framework that Removes TcO_4^- from Solution," *Angewandte Chemie*, *Int. Ed.*, **2010**, *49*, 1057-1060.
5. S. Wang, E. V. Alekseev, J. Ling, S. Skanthakumar, L. Soderholm, W. Depmeier, T. E. Albrecht-Schmitt, "Neptunium Diverges Sharply from Uranium and Plutonium in Crystalline Borate Matrixes: Insights into the Complex Behavior of the Early Actinides Relevant to Nuclear Waste Storage," *Angewandte Chemie*, *Int. Ed.*, **2010**, *49*, 1263-1266. *Selected for Cover Art Feature*
4. A.-G. D. Nelson, T. H. Bray, and T. E. Albrecht-Schmitt, "Capitalizing on Differing Coordination Environments and Redox Potentials for Preparing an Ordered Heterobimetallic U(VI)/Np(IV) Diphosphonate," *Angewandte Chemie*, *Int. Ed.* **2008**, *47*, 6252-6254.
3. R. E. Sykora, Z. Assefa, T. E. Albrecht-Schmitt, and R. G. Haire, "The First Structural Determination of a Trivalent Californium Compound with Oxygen Coordination," *Inorganic Chemistry*, **2006**, *45*, 475-477.
2. T. A. Sullens, R. A. Jensen, T. Y. Shvareva, and T. E. Albrecht-Schmitt, "Cation-Cation Interactions Between Uranyl Cations in a Polar Open-Framework Uranyl Periodate," *Journal of the American Chemical Society*, **2004**, *126*, 2676-2677.
1. A. C. Bean, C. F. Campana, O. Kwon, and T. E. Albrecht-Schmitt, "A New Oxoanion: $[IO_4]^{3-}$ Containing I(V) with a Stereochemically Active Lone-Pair in the Silver Uranyl Iodate Tetraoxoiodate(V), $Ag_4(UO_2)_4(IO_3)_2(IO_4)_2O_2$," *Journal of the American Chemical Society* **2001**, *123*, 8806-8810.

Los Alamos
NATIONAL LABORATORY
National Security Education Center

Kenneth N. Raymond
Chancellor's Professor
Department of Chemistry
Berkeley, CA 94720

October 7, 2015

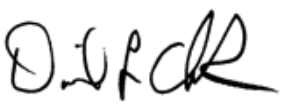
Re: Nomination of Dr. Thomas Albrecht-Schmitt for the GT Seaborg Award

I enthusiastically support the nomination of Thomas Albrecht-Schmitt for the G.T. Seaborg Award in Nuclear Chemistry. For 20 years Thomas has enriched the field of nuclear chemistry and its applications by introducing new tools and techniques from solid-state synthesis to the field. Tom's research approach, and the actinide materials that he has prepared and characterized are unquestionably unique in the world (see *Nature Chemistry*, **2014**, *6*, 387). His academic career is marked with an impressive publication record of 240 peer-reviewed publications, and a list of "scientific firsts" in an area of chemistry that requires excellent technique, safety awareness, chemical intuition and experimental diligence. He has introduced fresh new ideas to create entirely new and complex inorganic systems, and opened up new frontiers in the synthesis, reactivity, spectroscopy, and electronic structure theory of actinide inorganic compounds.

Tom employed hydrothermal synthetic methods (see *Chem. Commun.* **2003**, *4*, 478) to systematize the light actinide (Th, U, Np, Pu, Am, Cm and Cf) iodates, borates, fluoroborates, silicates, sulfates, selenites, hydroxides, aluminosilicates. Along the way, he discovered new coordination modes for actinide complexes (*Angew. Chem., Int. Ed.* **2008**, *47*, 6252), stabilized actinides in unusual oxidation states (*Inorg. Chem.*, **2012**, *51*, 4432), produced a large number of new crystal structures and structural types within our field (*Inorg. Chem.*, **2014**, *53*, 3148), and introduced the community to new approaches to micro-scale characterization. Prior to Tom's effort, I was convinced that one had to work within the DOE Laboratory system, where one could handle and manipulate reasonable quantities of radioactive materials in order to successfully characterize and manipulate such compounds. With a battery of new synthetic approaches, and micro-spectroscopic characterization, Tom has changed the way I think about this field, and proven that academic researchers can still have a huge impact on this field. Tom is one of only a handful of people who have **ever** worked with elements beyond americium. Through Tom's effort, he has produced a body of work that spans some 240 publications with over 5300 citations in less than 20 years.

Thomas is an excellent communicator, and one of the most engaging scientists with whom I have worked. He is an influential and guiding national force in the field of inorganic f-element chemistry. He richly deserves to be singled out for this recognition of outstanding, sustained, scientific and technological contributions the field. I give Thomas Albrecht-Schmitt my highest recommendation for the G.T. Seaborg Award.

Sincerely,



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WASHINGTON STATE UNIVERSITY
Department of Chemistry

October 26, 2015

Selection Committee
2016 Glenn T. Seaborg Award of the American Chemical Society

SUBJECT: Letter of Support for Prof. Thomas Albrecht-Schmitt's nomination for the 2016 Glenn T. Seaborg Award of the American Chemical Society

Dear Award Selection Committee:

I am writing to support the nomination of Prof. Thomas Albrecht-Schmitt, Florida State University, for the 2016 Glenn T. Seaborg Award of the American Chemical Society. As stated by the American Chemical Society, the purpose of the award is to recognize and encourage research in nuclear and radiochemistry or their applications.

Prof. Albrecht-Schmitt has dedicated his career to understanding the behavior of the trans-plutonium elements in materials, making him a rather unique researcher in the area of actinide inorganic chemistry. Through his work, he has demonstrated key properties of the 5f elements that were previously unknown. For example, he has worked with colleagues from Argonne National Laboratory and other university investigators to understand the chemistry of californium. Through that work it is now recognized that Cf behaves as a second transitional element in the actinide series. This team of researchers has also explored the interaction of Cf with anions such as borate. This body of work has been featured in numerous chemical periodicals and the popular press. Within this team of researchers, Prof. Albrecht-Schmitt shows tremendous ingenuity and creativity. Because of the work by Prof. Albrecht-Schmitt and his collaborators, we now understand much more about the basic inorganic chemistry and periodicity of the 4f and 5f elements.

In his role as a faculty member at Florida State University, Prof. Albrecht-Schmitt is a tireless teacher and mentor. He has trained many post-doctoral associates, graduate students and undergraduate students who have gone on to independent careers in chemistry. He directs a large and thriving research group at Florida State University. His dedication to developing the future generations of inorganic actinide chemists is consistent with the devotion to teaching that Prof. Glenn T. Seaborg demonstrated throughout his career. Because of Prof. Albrecht-Schmitt's contributions to 5f inorganic chemistry and his dedication to teaching and service, I strongly support his nomination for the ACS Seaborg Award.

Sincerely,

Sue B Clark

Sue B. Clark, Ph.D.
Regents Professor
Department of Chemistry
Washington State University

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