



The **Kroll**

ZIRCONIUM MEDAL

Award

APRIL 2025

Aix-en-Provence
France

Previous Recipients

- 1975 — **Admiral H.G. Rickover**, U.S. Navy, USA
1976 — **Dr. Brian Cox**, Atomic Energy of Canada Ltd. (AECL), Canada
1978 — **Dr. Benjamin Lustman**, Bettis Atomic Power Laboratory, USA
1980 — **W.W. Stephens**, U.S. Bureau of Mines, USA
1982 — **Stephen W.H. Yih**, Wah Chang, USA
1983 — **Dr. M.L. Picklesimer**, USNRC (Retired), USA
1984 — **Dr. F.A. Nichols**, Argonne National Laboratory, USA
1985 — **R.P. Syre**, CEZUS, France (Retired)
1986 — **MISHIMA**, Yoshitsugu, Japan (Retired)
1987 — **J.M. Googin**, Martin Marietta Energy Systems, Inc., USA
1988 — **P. Besson, J. Guerin, and P. Brun**, CEZUS France
1989 — **Dr. V. Fidleris**, AECL, Canada
1990 — **Dr. Antonina V. Nikulina**, All-Union Scientific and Research Institute, Russia
1991 — **Dr. J.S. Armijo, Dr. Louis F. Coffin, Jr., and Dr. Herman S. Rosenbaum**, General Electric, USA
1992 — **David O. Pickman**, UKAEA (Retired), UK
1993 — **J.A.L. (Archie) Robertson**, AECL (Retired), Canada
1994 — **Frederich Garzarolli, Dr. Heinz Stehle** (Retired), and **Eckard Steinberg**, Siemens AG, KWU, Germany
1995 — **Dr. Ronald B. Adamson**, GE Nuclear Energy, USA
1996 — **Dr. Charles Ells and Dr. Anthony Sawatzky**, AECL, Canada
1997 — **Dr. Daniel Charquet**, CEZUS, France
1998 — **Dr. C.E. Coleman**, AECL, Canada
1999 — **Dr. Clément Lemaignan**, CEA, France
2000 — **John Schemel**, Sandvik Special Metals (Retired), USA
2001 — **Dr. George Sabol**, Westinghouse (Retired), USA
2002 — **Dr. Erich Tenckhoff**, Siemens (Retired), Germany
2003 — **Dr. Kjell Petterson**, Studsvik Energiteknik, Sweden
2004 — **Prof. Richard Holt**, Queen's University, Canada
2005 — **Dr. Malcolm Griffiths**, AECL, Canada
2006 — **B.J. Sanders**, Sterling Chemicals (Retired), USA
2007 — **Mr. John G. Banker**, Dynamic Materials Corporation, USA
2008 — **Dr. David Franklin**, EPRI, Bettis Atomic Power Laboratory and DOE, USA
2009 — **Dr. Viatcheslav N. Shishov**, Bochvar Institute (VNIINM), Russia
2010 — **Dr. Brian A. Cheadle**, AECL (Retired), Canada
2011 — **Mr. John J. Kearns**, Bettis Atomic Power Laboratory, USA
2012 — **Dr. Srikumar Banerjee**, Bhabha Atomic Research Centre, India
2013 — **Dr. R.A. Murgatroyd, UKAEA (Retired), and Dr. A. Rogerson**, AMEC Foster Wheeler (Retired), UK
2014 — **Prof. A.T. Motta**, Pennsylvania State University, USA
2015 — **Dr. T. Fuketa**, Nuclear Regulatory Authority, Japan
2016 — **Mr. Peter Rudling**, ANT International, Sweden
2017 — **Mr. Bruce Kammenzind**, NNL Bettis Laboratory, USA
2018 — **Prof. Michael Preuss**, University of Manchester, UK
2019 — **Dr. Anand M. Garde**, ZiraShri, LLC and Engineer Emeritus, Westinghouse, USA
2020 — **Dr. Bo-Ching Cheng**, EPRI, USA
2021 — **Mr. Richard Sutherlin**, Richard Sutherlin PE Consulting LLC, USA

The **Kroll** **ZIRCONIUM MEDAL** **Award**

THE WILLIAM J. KROLL ZIRCONIUM MEDAL has been established to recognize outstanding achievement in the scientific, technological or commercial aspects of zirconium production and utilization, and to encourage future efforts, studies and research. Once regarded as a rare metallurgical curiosity, this exotic metal has been proven to possess exceptional properties which made it suitable for use in nuclear reactors and to possess exceptional resistance to corrosion in most media.

The naming of the medal for Dr. W.J. Kroll is most appropriate in that he and his colleagues in the U.S. Bureau of Mines developed the process that could be carried out on a commercial scale so that the one-time laboratory curiosity could become an article of commerce.

The concept of the medal was initiated by Wah Chang, a company which produced unusual metals, including zirconium, by the Kroll Process. The recipients of the medal are selected by a standing international committee charged with recognizing historically unique and significant contributions to zirconium alloy production and technology. The administration of the award had been a function of the W.J. Kroll Institute for Extractive Metallurgy of the Colorado School of Mines which was established by gifts from the late Dr. Kroll. In 1982, the ASTM B10 committee on reactive and refractory metals became co-sponsors of the medal award. In 2003, the Kroll Institute could no longer provide support for this award and the ASTM International B10 committee assumed full responsibility for its funding and administration.



Recipients

2022 — Dr. Ted (Edward) Darby

Dr. Ted (Edward) Darby worked with Rolls-Royce for 42 years, before retiring in 2019. He began his career in 1977 as a metallurgist responsible for in-reactor behavior of PWR fuel and cladding materials including in-reactor experiments at Harwell on irradiation creep and growth of zirconium alloys. Throughout his career he remained closely involved with research on zirconium alloys including programs on environmental fatigue, the effect of irradiation on hydrogen solubility, the effect of hysteresis in hydrogen solubility on critical temperatures for Delayed Hydride Cracking, and in-reactor corrosion and hydrogen ingress. He has worked with colleagues and peers within the international community leading the Rolls-Royce involvement in collaborative research programs within industry and academia and was influential in the revitalization of academic research on nuclear materials in the UK. Dr. Darby's contributions to Rolls-Royce's capabilities, along with his continued involvement and support of industrial and academic research programs on zirconium alloys, are exceptional.

2023 — Halden Reactor Project

The Halden Test Reactor operated for six decades, before being shut down in 2019. During its operational years, the reactor made invaluable contributions to the nuclear industry through a series of international projects focused on nuclear fuel and materials research. It was the longest-running joint international project of the OECD Nuclear Energy Agency (NEA). The Halden Reactor Project (HRP) had approximately 20 member nations, including over 100 organizations, underscoring the significance and global impact of its research. Key experimental series, relevant to zirconium-alloy fuel rod cladding, were conducted within the HRP. Notable experiments included investigations into cladding corrosion, cladding creep, rod-overpressure, clad lift-off, Loss of Coolant Accident (LOCA) tests, and dry-out experiments. The results of these studies, which focused on cladding performance, provided crucial data that has significantly benefited the global nuclear community. Scientists and researchers from member organizations were regularly seconded to the HRP to assist in the design, execution, and analysis of experiments. This collaboration fostered an extensive exchange of knowledge within the fuel and materials research community and ensured that HRP's findings were broadly utilized. Notable contributors to HRP's zirconium-related research include the following individuals: **Peter Bennett**, Chief Chemist; **Torill Karlsen**, Materials Scientist; **Reka Szöke**, Chemist, Materials Expert; **Terje Tverberg**, Physicist, Nuclear Fuel Expert; **Margaret McGrath**, Materials Scientist, Manager of HRP Fuels and Materials Program; **Erik Kolstad**, Fuels and Materials Expert; **Wolfgang Wiesenack**, Physicist, LOCA Expert, Manager of HRP.

2024 — Dr. Jean-Christophe Brachet

Dr. Jean-Christophe Brachet graduated as a materials science engineer from Polytech Lille Engineering School in 1986 and received his PhD from Paris-South (now, Paris-Saclay) University in 1991. After ten years devoted to martensitic steels for advanced nuclear reactors and Ti-Ni shape memory alloys, his last 30 years career at CEA was mainly focused on the study of metallurgical behaviors of Zirconium-based nuclear fuel claddings, especially under hypothetical Loss-Of-Coolant Accident conditions. He contributed significantly to the understanding of phase transformations, diffusion and chemical partitioning of oxygen and hydrogen and their impact on mechanical properties. He was also in charge of the development and evaluation of innovative claddings, i.e., Er containing Zr alloys for High Burn-Up applications. During his last 12 years' career at CEA, Dr. Jean-Christophe Brachet led the development and evaluation of Cr-coated claddings, which are now internationally recognized as the reference Enhanced-Accident-Tolerant-Fuels concept for LWR applications.

Wednesday, April 16, 2025

AIX-EN-PROVENCE, FRANCE

MASTER OF CEREMONY

Dr. Pierre Barberis, Framatome, France

WELCOME AND INTRODUCTION ON BEHALF OF ASTM INTERNATIONAL

Dr. Anand M. Garde, Chair, Kroll Award Selection Committee and B10 Symposium Sub-committee, ZiraShri LLC, USA

KROLL COMMITTEE REPORT

Dr. Anand M. Garde, Chair, Kroll Award Selection Committee and B10 Symposium Sub-committee, ZiraShri LLC, USA

PRESENTATION OF THE WILLIAM J. KROLL ZIRCONIUM MEDALS AND CITATIONS

Dr. Pierre Barberis and **Dr. Anand M. Garde**

HISTORICAL ACCOUNTS BY THE MEDAL RECIPIENTS

Dr. Ted (Edward) Darby
Retired from Rolls-Royce, UK

Dr. Reka Szöke
Representative of Halden Reactor Project, Norway

Dr. Jean-Christophe Brachet
CEA, France



Award Selection Committee

Mr. John Banker

Clad Metal Consulting
Lyons, Colorado, USA

Dr. Pierre Barberis

Framatome
Ugine, France

Dr. Ted (Edward) Darby

Rolls-Royce
Derby, UK

Dr. Anand M. Garde, Chair

ZiraShri LLC
Engineer Emeritus, Westinghouse
Columbia, South Carolina, USA

Mr. Brett Herb

ATI Specialty Alloys & Components
Albany, Oregon, USA

Dr. Valadamir Markelov

Bochvar VNIINM
Moscow, Russia

Dr. Sheikh T. Mahmood

Consultant, ANT International
Pleasanton, California, USA

Dr. Heidi Nordin

Canadian Nuclear Laboratories
Chalk River, Canada

Dr. Clara Anghel

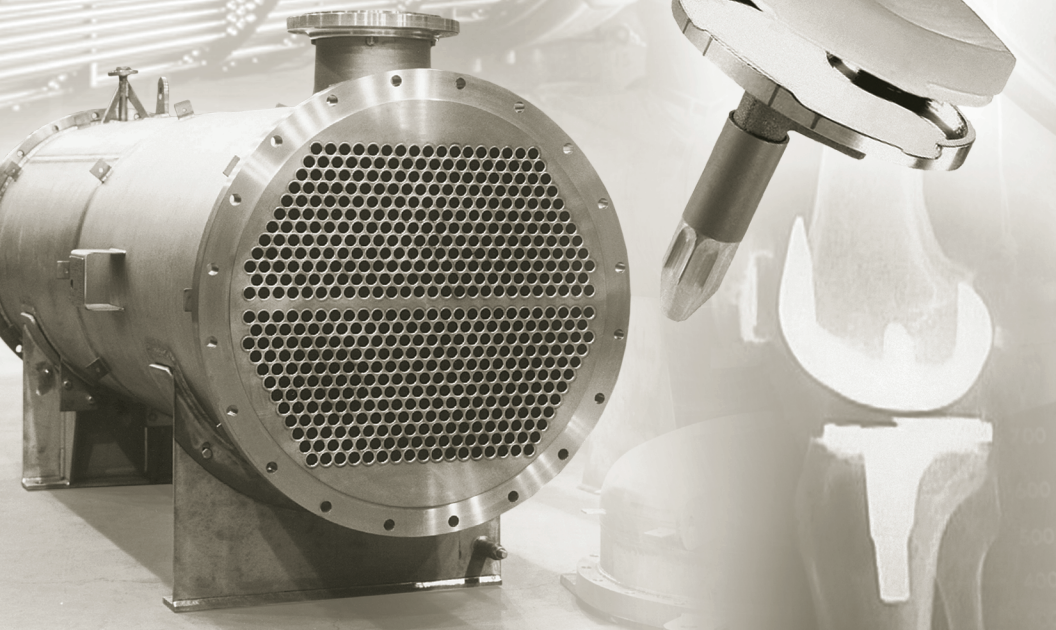
Vattenfall Nuclear Fuel
Stockholm, Sweden

Dr. Gautam Dey

Retired from Bhabha Atomic
Research Center
Trombay, India

Dr. Chunrong Xu

Nuclear Power Institute of China
Chengdu, China



Profile

DR. WILLIAM JUSTIN KROLL was one of the foremost metallurgists of our times. He was a devoted experimentalist with a remarkable ability to ascertain the scientific and industrial significance of results obtained in the laboratory. As a young man, Dr. Kroll was recognized for discovering a process to remove bismuth from lead. Later he devised the first commercial process to produce titanium — the Kroll process. His last large-scale endeavor was a procedure to produce ductile zirconium; the resulting metal was used in building the reactor for the first nuclear submarine.

Born in Luxembourg, Dr. Kroll received his university training in Germany. He worked for the Metallgesellschaft until he established his own research laboratory in Luxembourg. He turned out an astonishing series of metallurgical developments on such diverse subjects as beryllium production, age-hardenable alloys, vacuum metallurgy, and especially the production of zirconium by the reduction of chloride with magnesium.

With the start of World War II, he moved to the United States, working for four years with Union Carbide in Niagara Falls and then transferring to Oregon as consultant to the U.S. Bureau of Mines. He lived for many years in Corvallis, Oregon, before returning to Europe, where he built a house in a suburb of Brussels to be near his brother, Theodore.

W.J. Kroll died in March 1973 — he was never married, but he left a host of friends and admirers.



William



The Kroll Medal Selection Committee and ASTM International gratefully acknowledge ATI for fabrication and engraving of the Kroll Medals.

