= Cyril Stanley Smith =

Cyril Stanley Smith ( 4 October 1903 ? 25 August 1992 ) was a British metallurgist and historian of science . He is most famous for his work on the Manhattan Project where he was responsible for the production of fissionable metals . A graduate of the University of Birmingham and Massachusetts Institute of Technology ( MIT ) , Smith worked for many years as a research metallurgist at the American Brass Company . During World War II he worked in the Chemical @-@ Metallurgical Division of the Los Alamos Laboratory , where he purified , cast and shaped uranium @-@ 235 and plutonium , a metal hitherto available only in microgram amounts , and whose properties were largely unknown . After the war he served on the Atomic Energy Commission 's influential General Advisory Committee , and the President 's Science Advisory Committee .

Smith founded the Institute for the Study of Metals at the University of Chicago , the first interdisciplinary academic organization devoted to the study of metals in the United States . He studied the details of faults and grain boundaries in metals , and developed theoretical models of them . In 1961 , he moved to MIT as an Institute Professor with appointments in both the Departments of Humanities and Metallurgy . He applied the techniques of metallurgy to the study of the production methods used to create artefacts such as samurai swords .

= = Early life = =

Smith was born in Birmingham , England , on 4 October 1903 , the third of four children of Joseph Seymour Smith , a commercial traveller for Camp Coffee , and his wife , Frances , née Norton . He was educated at Bishop Vesey 's Grammar School in Sutton Coldfield . He read metallurgy at the University of Birmingham , having not met the requirements in mathematics to study his first choice , which was physics , and was awarded a second @-@ class BSc in 1924 .

That year Smith entered the Massachusetts Institute of Technology ( MIT ) , where he earned a ScD in 1926 . He was a research associate at MIT from 1926 to 1927 , then left to take up a position as a research metallurgist at the American Brass Company . His research there was mainly involved with the electrical , thermal , and mechanical and magnetic properties of copper alloys . He published numerous papers , and was awarded 20 patents .

He married Alice Marchant Kimball , a student of English social history at Yale University , from which she earned a PhD in 1936 , on 16 March 1931 . Of the marriage , Alice 's sister remarked that : " If he didn 't go to Oxford or Cambridge , isn 't Church of England , and doesn 't like sports , you might as well marry an American " . He became a naturalized American citizen in 1939 . His wife sparked an interest in history , a subject that he had disliked at school . He acquired old texts , and in 1945 he produced a translation of a classic metallurgical text , Vannocio Biringuccio 's Pirotechnia ( 1540 ) .

= = World War II = =

In 1942 , during World War II , he was called into service at the War Metallurgy Committee in Washington , D.C. In April 1943 he went to work on the Manhattan Project , joining the Chemical @-@ Metallurgical Division at the Los Alamos Laboratory as the head of its Metallurgy Group . When the laboratory was reorganized in April 1944 , he became the Associate Division Leader in charge of metallurgy . His first task was recruiting metallurgists , who were in great demand by the war effort . He also had to arrange for the transport of their metallurgical equipment to Los Alamos under wartime conditions .

Smith 's metallurgists found ways of fabricating boron , producing beryllium bricks , and heat @-@ treating steel . They also had to work with uranium . Frank Spedding had developed a large @-@ scale process for producing pure uranium metal at the Ames Laboratory which was fine for producing tons of feed for the nuclear reactors , but enriched uranium could not be handled in this way , as it would form a critical mass . Smith was initially asked to produce cubes of uranium hydride , which he did , but a uranium hydride bomb was found to be inefficient , and the idea was set aside

for the duration , although further work was carried out after the war . By July 1944 , they were producing pure uranium metal in 200g amounts with a newly devised process .

But by far the biggest challenge for Smith and his group was plutonium , a metal hitherto available only in microgram amounts , and whose properties were largely unknown . It was initially assumed that plutonium would have properties similar to that of uranium , but this assumption turned out to be invalid . Plutonium proved to be " the most complicated metal known to man " . There were found to be six allotropes of plutonium , more than any other metal , and its melting point turned out to be hundred of degrees lower than uranium . The metallurgists found that at around 125 ° C , plutonium expanded in volume by 20 percent , which is unusual .

Plutonium was delivered to Los Alamos in the form of what was found to be a mixture of plutonium trifluoride ( PuF3 ) and plutonium tetrafluoride ( PuF4 ) . Work with plutonium was carried out in gloveboxes for safety reasons . The metallurgists figured out how to purify the plutonium , and found that heating it to 250 ° allowed them to work it in the malleable ? phase . It was also found that alloying it with 3 percent gallium would stabilize it in the ? phase . When plutonium at last began to arrive in quantity from the Hanford Site in February 1945 , they were ready for production . In a race against the clock , the metallurgists produced plutonium spheres for the Trinity nuclear test by July 23 , 1945 .

Smith was awarded the Medal for Merit by President Harry S. Truman for these activities in 1946 .

= = University of Chicago = =

After the war Smith founded the Institute for the Study of Metals at the University of Chicago , the first interdisciplinary academic organization devoted to the study of metals in the United States . He considered it " a natural outgrowth of the close association of metallurgists with chemists and physicists on the Manhattan Project . " He developed methods for deriving the three @-@ dimensional shapes of the crystalline structures of metals from the two @-@ dimensional microscope images of the grains of the metals . He also studied the propagation of induced phase changes in metals . He was fascinated by the details of faults and grain boundaries in metals , and developed theoretical models of them . Perhaps his most influential paper was on " Grain Shapes and Other Metallurgical Applications of Topology " ( 1952 ) , an explanation of metallic microstructure . He was awarded a Guggenheim Fellowship in 1955 to study the History of Science and Technology .

From 12 December 1946 to 10 January 1952 , Smith served on the influential General Advisory Committee of the Atomic Energy Commission ( AEC ) . Chaired by Robert Oppenheimer , the wartime director of the Los Alamos Laboratory , the General Advisory Committee provided policy as well as technical advice to the commissioners . One of Smith 's first papers for the commission recommended that it concentrate on the development of fast breeder reactors and high flux reactors . A 1948 visit to England to discuss plutonium metallurgy with British scientists nearly escalated into an international incident , as Senator Bourke Hickenlooper and Secretary of Defense James Forrestal feared that he would give atomic secrets away to the British . Smith did no such thing ; but AEC Commissioner Sumner Pike faced severe criticism for authorizing Smith 's visit . In common with other members of the General Advisory Committee , Smith opposed the development of the hydrogen bomb on technical and moral grounds . He also served on the National Academy of Sciences ' Committee on Science , Engineering , and Public Policy and the President 's Science Advisory Committee .

= = Massachusetts Institute of Technology = =

In 1961 , Smith moved to MIT as an Institute Professor with appointments in both the Departments of Humanities and Metallurgy . His focus was to transplant the techniques of metallurgy into the study of the production methods used to create artefacts discovered by archaeologists such as samurai swords . In his role of teaching the history of science , he argued that important advances were often the result of curiosity rather than the pursuit of defined goals . He was interested in the

scientific aspects of fine arts , and published several works linking the arts with the sciences . He lectured about this at the Smithsonian Institution 's Freer Gallery of Art and the Arthur M. Sackler Gallery in Washington , DC .

Smith received numerous awards , including the Franklin Institute 's Francis J. Clamer Medal in 1952 , and the History of Science Society 's Pfizer Medal and American Society for Metals ' Gold Medal in 1961 . He was awarded the Society for the History of Technology 's Leonard da Vinci Medal in 1966 , and the Institute of Metals ' Platinum Medal in 1970 . In 1991 he received the American Institute of Physics ' Andrew Gemant Award for " pioneering the use of solid state physics in the study of ancient art and artefacts to reconstruct their cultural , historical and technological significance . " He was also a member of the editorial board of the Bulletin of the Atomic Scientists .

On retirement from MIT in 1969 , Smith became a professor emeritus of the History of Science and Technology , professor emeritus of Metallurgy and Humanities and Institute Professor Emeritus , an unusual title " reserved for only a few whose work transcends the boundaries of traditional departments and disciplines " . He died of colonic cancer in his Cambridge , Massachusetts home on 25 August 1992 . He was survived by his wife of sixty years , Alice Kimball Smith , his two children , Anne Smith Denman , chair of the Department of Anthropology at Central Washington University , and Stuart Marchant Smith , a marine geologist at the Scripps Institution of Oceanography , and a sister , Mary Smith . His papers are in the Niels Bohr Library in College Park , Maryland . His collection of antiquarian metallurgical texts was left to the Burndy Library at the Dibner Institute for the History of Science and Technology .

= = Selected works = =

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