PETER HAASEN

1927–1993

BY ANTHONY KELLY

PETER HAASEN was professor of metal physics at the Georg August University of Göttingen for thirty-four years from 1959. During that time his influence spread worldwide into almost every aspect of the theory and practice of dislocation mechanics. His ideas and the beautiful experiments performed by him and his coworkers affect almost all of materials science/engineering.

Haasen was the exemplar of the great and justly well-known professor, respected and listened to worldwide. He was also a kindly man of great warmth and personal loyalty to all that he took up.

The eldest of four brothers, born to a father who practiced law in Germany, Haasen completed elementary schooling in Gotha (Thüringen) and entered the gymnasium there, leaving in 1944. He was conscripted into the German Wehrmacht and was captured at the end of the war. He has described vividly the steps he took to ensure that he was captured by the Americans.

The breadth and the depth of Haasen's work in applied physics can be appreciated by looking at the issue of *Physica Status Solidi* (a) 131, Number 2, pages 263–736, published in 1992, which contains papers all dedicated to him on the occasion of his sixty-fifth birthday. He developed the field of physical metallurgy, especially in Germany, as a particular scientific discipline. This meant always insisting on a direct explanation based on the concepts of physics and persisting with this however

complicated the apparent phenomenon or experimental results. With this approach he advanced materials research across an astonishingly wide field of materials covering metals, semiconductors, superconductors, and ionic crystals. All complex phenomena had to be explained quantitatively in terms of microscopic structures and mechanisms, according to Haasen. Thus, again his work covers an amazing breadth of phenomena: plasticity mechanisms, fiber reinforcement, charging of dislocations, effects of high pressures, internal friction, fracture, and particularly the ductile brittle transition, besides recrystallization, texture formation as well as fatigue in metals and alloys, and the thermodynamics of metastable systems. He was well versed in phase transformation of all kinds and toward the end of his career was still insisting, quite rightly, that there is no coherent explanation of the phenomenon of recrystallization after cold work. He used the most sensitive experimental techniques, such as field ion microscopy, high-resolution electron microscopy, and a battery of physical techniques.

To avoid living under the Russians, in 1945 Haasen's father took the family to Göttingen, where Haasen obtained his Abitur and entered the University of Göttingen. Here he developed a deep love of physics, studying it with mathematics, physical chemistry, and metallurgy. He obtained his diploma in 1951 and in a remarkably short time a Ph.D. for work on crystal plasticity. He was influenced greatly by the accuracy of Richard Becker and the flamboyant and dynamic Günther Leibfried who was then enthusiastically pursuing the theory of dislocations.

After receiving his Ph.D. in 1953 Haasen worked for a year as scientific assistant and then went to the Institute for the Study of Metals of the University of Chicago to work with C. S. Smith and C. S. Barrett. There, under the influence of A. W. Lawson, he showed what a brilliant experimentalist he could be, though his first love was theory, by a series of experiments on the deformation of nickel single crystals at low temperatures and the effect of pressure on their deformation. He discovered a still unexplained upper yield point on reloading metal crystals dubbed by Hans Weertman the "Haasen-Kelly" effect

and was the first to investigate the nature of the core of a dislocation in indium antimonide—a III-V semiconductor. These early experiments and his theory of them show how the breadth of his work always carried well outside normal studies of plasticity of single crystals. Haasen chose nickel because it was ferromagnetic, In Sb because it was a compound semiconductor, and pressure as an independent variable because he could study density changes. All of these show the outstanding physicist turning his attention to the complicated problems of metallurgy.

Haasen returned to Germany in 1956 to the Max Planck Institute (MPI) at Stuttgart, where he worked with Werner Köster. At that time he married Barbara Kulp, a student studying mathematics, whom he knew from the University of Stuttgart. She has borne him three beautiful daughters and supported him in all that he has done. At the very early age of thirty-one, Peter Haasen was elected to the Lehrstuhl für Metallphysik u allgemeine Metallkunde (physics of metals and general metallurgy) at the University of Göttingen, succeeding Georg Masing in this position. This was a famous chair of metallurgy, having been previously occupied by Gustav Tannan. Haasen remained in the post until he retired in 1992, though soon after his appointment he changed the department name to metal physics. Due to delay in appointing a successor, he remained in partial charge until 1993.

He built the department almost from scratch, increasing the staff by more than a factor of ten and over the years developing all his interests. Today, at Göttingen, there are individual sections, each headed by a leading professor of metal physics, metallurgy, solid-state theory, and crystal growth. Haasen began by equipping the institute and having a workshop built. With the discovery of hard superconductors in the early 1960s, he moved vigorously into that field. After his visit to Cambridge in 1961, he set up electron microscope investigations of the highest resolving power and introduced field ion microscopy.

These techniques allied with physical measurement enabled him to contribute to the understanding of the early stages of aging of supersaturated alloys and to the development of his

ideas on solid solution strengthening. His group's experiments on the deformation of semiconductor crystals soon led to his being recognized as a world expert, particularly on the electrical effects of dislocations in these materials. Because of the breadth of the work he supervised, he was able to generalize the idea of hardening from merely describing mechanical hardness to embracing magnetism and superconductivity.

Haasen personally is to be recognized as an early pioneer of applying the dislocation theory to the mechanical properties of metals. He was one of the first to obtain experimental results on the dynamical formation of slip bands in metals. He established the existence of high-temperature deformation in germanium and other diamond structure materials and carried out a comprehensive set of experiments on the dislocation generation and mobility in ionic solids. He also brought together, in a comprehensive fashion, diverse experimental and theoretical work on the mechanism of solid solution strengthening in metals and in alloys.

Haasen made many visits abroad from Germany: to Cambridge in 1961, to Pennsylvania in 1963 and 1971 (to Carnegie and Mellon in 1963—they were separate institutions then—and to Philadelphia in 1971), to Paris in 1978, and as Schottky Professor to Stanford in 1984 and again in 1988. He visited the Far East on a number of occasions. He learned French in Villefranche in the south of France and was justly proud of his ability in three languages. Through these visits and the use of the Humboldt Foundation and his great industry as a correspondent, Göttingen had many visitors, all of whom remember with affection their visits and the welcome afforded them scientifically and with great good fellowship by Peter and his devoted wife, Barbara.

Haasen was tireless in his support of the profession of metal physics and of modern metallurgy and materials science, the last term is not often used in German. He was a member of the American Physical Society, of the Göttingen Academy of Sciences (president 1981–1983). He was a board member of the German Physical Society of the German Society for Materials Research (chairman 1985–1986); an external member of the

MPI for Metals Research in Stuttgart; and a member of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME).

He received many international awards, including the Heyn medal of the German Society for Metallurgy (DGM)—now the German Society of Materials—in 1976 and the Robert Franklin Mehl Award of the Metallurgical Society of AIME in 1985. He was elected a foreign associate of the National Academy of Engineering in 1981. He received the Van Horn Distinguished Lectureship of Case Western Reserve University in 1986, the Le Chatelier Grand Medal of the French Society for Metallurgy in 1987, and the German-French Alexander von Humboldt prize for Franco-German cooperation in 1989. Had he lived he would have received the *Acta Metallurgica* Gold Medal in 1994. He was a founding member of the Academia Europea—the European Academy of Arts and Sciences in 1990—being instrumental in introducing materials science as a discipline into that body. He had been elected to the German equivalent, the Leopoldina, in 1986.

Haasen was particularly concerned to develop cooperation between German scientists and those from lands to the East and from Israel. He was a member of the Technion (Haifa) Board of Governors for many years. He helped a number of Jewish scientists to leave the USSR, as it then was, in order to settle in Israel. He was extremely touched to learn on his deathbed of the award to him of an honorary doctorate by the Technion.

Haasen's contribution to publishing in the field of materials science has been enormous; besides more than 220 publications authored by him and his famous text *Physical Metallurgy,* he was on the editorial board of *Zeitschrift für Metallkunde, Acta Metallurgica, Scripta Metallurgica, Progress in Materials Science, Materials Science and Engineering,* and *Physica Status Solidi*. He was also a general editor with R. W. Cahn and E. J. Kramer of the multivolume comprehensive treatment published by VCH, Materials Science and Technology. He was looking forward to continuing this editorship when he died.

Haasen never left Göttingen although he received many offers; some pressed home with force. He was offered the

directorship of the Physikalische Technische Bundesanstalt—the German equivalent of the U.S. National Bureau of Standards, now the National Institute of Standards and Technology (or of the National Physical Laboratory in the United Kingdom)—to succeed Martin Kersten and Ulrich Stille; he was pressed to go to the University of Saarbrücken, but the students at Göttingen persuaded him to stay. As the quintessential dignified professor, the student revolts in 1968 or so deeply upset his moral sense. He was unfortunate in being dean of the faculty of science at Göttingen at the time. He probably would have accepted an appointment as head of department at Stanford, where he and Barbara had much enjoyed their stays, but the German method of employing professors prevented him.

Haasen was a big man physically and in other senses. This combined with his intellect and style of speech to give his statements a certain majesty and to show him to others as a sort of avuncular figure, as he was to many colleagues and friends. These qualities, coupled with a massive integrity, gave him great authority, and all who knew him trusted him implicitly. He was a very devout Christian and an elder member of the university/church organization in Göttingen. He was very kind and his actions showed his great desire to promote friendship between individuals and between nations. Some of the remarks above show how successful he was. His relaxations outside science included taking long walks—often talking about science and music (Mahler and Bruckner were his favorite composers). He acquired compact discs as soon as they emerged.

His loves were physics (of the messy situations of the solid state) and all those people who showed some competence in this area from wherever each might come and not secondly, his family. He was physically very brave and had fought disease—losing an organ, which he revealed to few, some twenty years before his death. He was a great teacher, researcher, and supporter of materials physics. He was very proud of his associateship in the National Academy of Engineering and we, I am sure, are proud of him.