Dedication: Professor Josef Čadek

The contributions by Professor Čadek to the understanding of creep processes in metallic materials

This special issue of Kovove Materialy-Metallic Materials is designed to honour, on his after death 80th birthday, the lifetime contribution of Josef Čadek to the understanding of creep processes in metallic materials. The contributors to this issue are some of the many who were fortunate enough to be inspired by Josef Čadek's insight into problems of creep deformation and fracture of metallic materials at high temperatures.

Professor Josef Čadek was born on 22 February 1925 in Koryta, Czechoslovakia. He graduated in 1949 in physical metallurgy at the Faculty of Metallurgy of the Technical University, Ostrava. In 1955, he completed his studies with a PhD degree in physical metallurgy at The Iron and Steel Institute in Moscow, Russia. In 1961, he received a DrSc. degree for a doctoral thesis entitled Precipitation of Carbides in Ferritic Steels. From 1955 to 1964, he was the Research Director at The Iron and Steel Institute in Prague. Simultaneously, he was active as a Professor of physical metallurgy at the Technical University, Ostrava. In 1964, Josef Čadek moved to Brno where he was appointed a Deputy Director of the Institute of Physical Metallurgy of the Czechoslovak Academy of Sciences (in 1994 renamed to Institute of Physics of Materials of the Academy of Sciences of the Czech Republic). Between 1990 and 1993, he was director of this Institute and after his retirement in 1996, he continued his active work at the Institute to his very last days as Emeritus Research Scientist. Figure 1 showing the number of journal publications of Professor Čadek proves his extensive activity.

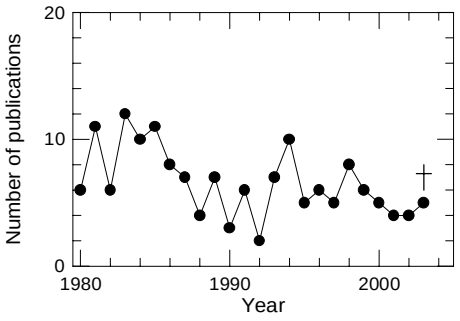

Fig. 1. Annual publication rate of Professor Josef Čadek (according to Web of Science).

His research interests covered a wide range in the fields of phase transformations and microstructural changes, dislocation structures and other defects in crystals, thermally activated deformation processes, diffusion and damage processes, and various other topics, mostly related to the theory of high-temperature behaviour and properties of metallic materials. His fundamental monograph Creep in Metallic Materials (Elsevier Science Publishers, Amsterdam 1988) provided a comprehensive review of the state of knowledge of mechanisms of high-temperature

creep deformation, creep damage and creep fracture in metals and alloys. The monograph arose from his long-term research activity at the Institute of Physics of Materials in Brno.

Professor Čadek has made outstanding contributions to knowledge in numerous areas related to the creep properties and behaviour of materials, as attested by his over 300 scientific papers in the international literature. From among these many areas, the following four topics were chosen here to highlight his career at the Institute of Physics of Materials AS CR. In each of these areas the work of Professor Čadek and his co-workers has been of fundamental importance.

Creep Deformation Mechanisms: The outstanding contribution by Professor Čadek to the understanding of mechanisms of creep deformation of polycrystalline, mostly model metals and alloys can be traced back to the earliest period of Professor Čadek's involvement in studies of creep dating from the early sixties. The contributions of Professor Čadek and his co-workers include recognizing the thermally-activated nature of creep flow and its dependence on diffusion, explaining the effects of grain size and the effective and internal stresses in dislocation creep, developing the back stress concept in power-law creep of metals, quantifying the effects of stacking-fault energy on creep rate in the high temperature creep of metals and solid solutions, describing Class I and Class II creep behaviour in alloys, and explaining the importance of dislocation substructure and subgrain strengthening with the concept of constant structure creep. Among these scientific contributions he also co-authored a new design of the constant stress tensile and compression creep testing machines and was a founder of creep laboratories at the Institute of Physics of Materials in Brno, which have become known internationally.

Creep at Low Stresses and Intermediate Temperatures: Professor Čadek and his co-workers have made numerous contributions in the area of diffusional and/or viscous creep. These contributions were based on a new experimental procedure to evaluate creep data obtained by the helicoidal spring specimen technique. With Professor Čadek's rare combination of experimental skill and capacity for the analysis of results, the current theories of diffusional creep have been evaluated. The papers in this area set deal with various possible interpretations of low stress creep mechanisms.

Grain Boundary Sliding and Creep Damage: Professor Čadek's group applied expert quantitative metallography and stereology to the understanding of the role of grain boundaries in high temperature flow and fracture. The contributions include the role of grain boundary sliding in power law creep, grain boundary migration and accommodation of grain boundary sliding, models of grain boundary sliding, mechanisms of the formation of intergranular creep cavities, and their unconstrained and constrained growth. The assessment of the ultimate stage of intergranular damage in creep based on the measurement of quantitative damage parameters were experimentally determined for many metallic materials under a broad range of high

temperature loading conditions. These works have provided a new direction for the application of quantitative analysis of creep micromechanisms to engineering design and creep life assessment.

Creep Behaviour of Discontinuous Metal Matrix Composites: Metal matrix composites (MMCs) have the potential of combining metallic properties of ductility and toughness with reinforcement properties of high strength and high modulus. Over the last decade, the creep properties of discontinuous MMCs have been the subject of many creep studies by Professor Čadek and his co-workers that have aimed not only at assessing the potential of the discontinuous MMCs for use as structural high temperature materials but also at identifying the origin of creep strengthening in such materials. Special emphasis was given to the significance of the threshold stress and the effect of load transfer in creep analyses and modelling of various high temperature creep processes in MMCs.

Since the foundation of Kovove Materialy-Metallic Materials in 1963, Professor Josef Čadek had been a member of its Editorial Board. Apart from publishing important research papers on creep in the journal, he was thus even more frequently involved as a referee. His professional advice and constructive criticism will be missed by many colleagues.

Those of us who have had the opportunity to work with Professor Josef Čadek are deeply appreciative of our good fortune and of this chance to pay him tribute. With these thoughts in mind we are proud to dedicate this issue to Professor Josef Čadek.

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