

Ing. Andrej Šalak, DrSc. - 90 years - his working activities and results



Andrej Šalak, one of the longest-serving powder metallurgists, celebrates his 90th birthday on October 20, 2014. Andrej was born on October 20, 1924 in Kamenica nad Cirochou in Eastern Slovakia. He graduated from the College of Mechanical and Electrical Engineering, Faculty of Mechanical Engineering at the Czech Technical University in Prague (ČTU) in the year 1949. Then he worked for technical positions in manufacturing plants in Czechoslovakia for several years. In 1959 he began working in the then "Laboratory of Metallurgical and Engineering Technology" of Slovak Academy of Sciences (SAS) in Košice. He became a head of Department for research of

properties of deep-drawing sheets for VSŽ Košice (metallurgical plant). On the topic of this material area he defended his dissertation in 1965 (PhD).

In 1966 he became head of the Department of Basic Research in the Field of Ferrous Powder Metallurgy, now already in the Institute of Experimental Metallurgy of SAS. Within this department, among other tasks he also led the research and development for production of iron powders from high-purity iron ore on the basis of the industrial business requirements of ZVL Dolný Kubín and in order to make Czechoslovakia less dependent on powder imports. This production, which was based on successful research and development, was carried out from 1968 and ended in 1987. It yielded new knowledge of the kinetics of the reduction of iron oxides. He provided also the laboratory testing the reduction of iron oxides coming from the pickling batches in the metallurgical plant VSŽ.

In the frame of the project for increasing the mechanical properties of sintered steels he focused on the relationship between porosity and mechanical properties of sintered steels.

The Commission of SAS awarded him the qualification degree II. a – "Senior researcher".

In 1972 he was withdrawn as the head of unit for political reasons, but he remained a leading investigator in the department of research projects within the five-year plans and of the tasks on the basis of industrial contracts. Personally he started the development of sintered alloy steels, focusing his attention to manganese as an alloying element because of its specific properties, to replace expensive nickel and copper, since Mn is the cheapest alloying element even in classical metallurgy.

He was principal investigator for the cooperations with the "Zentralinstitut für Festkörperphysik und Werkstoffforschung" Dresden and other tasks with the „Institut für Chemische Technologie anorganischer Stoffe“ at Technische Universität Wien. Under his leadership and based on industrial contracts, for Strojárne in Dubnica the production of gears for hydroelectric generators via powder metallurgy pumps was developed to replace the more expensive production by machining of steel bars, and for the Research Institute of Electrical Rotating Machines (VUEST) in Brno, powder metallurgy electromagnetic brakes for large electric motors were developed, which was also patented.

Andrej Šalak contributed significantly to the development of powder metallurgy as a member of the organizing committees of international conferences in Czechoslovakia,

held from 1974 to 1987 in cooperation with the GDR and Poland. For his active work in the Czechoslovak Scientific and Technical Society (ČSVTS) in the field of powder metallurgy, he has received several awards. He specially organized seminars about sintering of moulded parts made by powder metallurgy in Slovakia in three-year cycles. From these workshops, also Proceedings were issued.

In 1978 his employment at the institute was discontinued, for political reasons. His intense knowledge of manganese not being recognized at that time, and he could not find any other employment in Košice. Therefore he started his work in the "Research Institute for the Rationalization and Automation of Manufacturing Roller Bearings" in Žilina (ZVL-VURAL) within the group - Plants for the bearings production. For this Institute he proposed and established a new research department and initiated and successfully completed a project to produce bearing rings via powder forging of steels. The aim of the project was to reduce production costs for roller bearings compared to the classical method. Lifetime tests of bearings with powder forged rings showed that these rings reached by 100% higher lifetime compared to bearings with rings of classical wrought bearing steel. Considering the successful results of the endurance tests, calculations showed that the production cost for powder forged roller bearing rings decreased by 20% compared with the bearings rings from classical steel. This confirmed the success of this project that has been proposed and performed by Dr. Šalak. For operational production a complete automatic forging line for forging rings of 8 types of bearings was developed and established.

At the Žilina University of Transport (VŠD) he lectured powder metallurgy at seminars for which he drafted textbook, and he also acted as a supervisor for PhD students.

In 1983, the Commission SAS awarded him the qualification level I. - chief scientific worker.

In 1987 he elaborated a textbook for the three-month postgraduate course "Powder Metallurgy" at the Department of Materials Engineering, Technical University in Bratislava, where he went to hold lectures.

In 1995 he was awarded the *Gold Medal* of the Presidium SAS for scientific activities. In 1997 he defended his doctoral dissertation on the subject *Manganese in ferrous powder metallurgy*. Based on the defense he was awarded the scientific degree DrSc.

In 1990, he began working again at the Institute of Materials Research in Košice (IMR SAS) through the political rehabilitation. He worked in the Department of Powder Metallurgy. From 1999 to 2003 he was a member of the team in the NATO project - *Development of Powder Metallurgy Manganese Steels for Structural Components*, consisting of staff from the University of Bradford, UK, Institute of Materials Research of Slovak Academy of Sciences in Košice and IMS, Bulgarian Academy of Sciences in Sofia. The aim of the project was the production of sintered components alloyed with manganese, which was successfully implemented in the manufacturing enterprise ZVL Dolný Kubin. During all his working time at the Institute, until 2004, he dealt with the effect of manganese on sintering conditions and the mechanical and other properties of sintered materials alloyed with manganese.

In 2004, during the PM2004 Powder Metallurgy World Congress in Vienna he was awarded the *Distinguished Service Award* by the European Powder Metallurgy Association (EPMA).

The result of his research activities are 259 scientific articles published in journals, 41 of them registered in Current Contents, and 208 papers published in proceedings from national and international conferences, which were also published with co-authors. Furthermore, Andrej Šalak is inventor of 33 patents.

He was a member of the team of authors who developed the dictionary: *Technical translation dictionary German-Slovak*, published in 1993, contributing the technical terms of powder metallurgy, 1993. Further developed following monographs:

- *Sintered and powder forged structural steels*, 207 pages, 1981.
- *Ferrous Powder Metallurgy*, CISP, Cambridge UK, 453 pages, 1995. In 1998 he was awarded the SAS Presidium PRIZE for the development of powder metallurgy and for this monograph.
- *Machinability of Powder Metallurgy Steels*, written with two co-authors, CISP, Cambridge UK, 534 pages. The book was issued in 2005, and the second edition in 2006. This monograph was also published in India, ed. Viva Books New Delhi, in 2008.
- *Manganese in Powder Metallurgy Steels*, written with one co-author, CISP-Springer, 477 pages, 2012.

Based on previous knowledge and on his own original published investigations, in this monograph he proves that due to its high vapour pressure manganese sublimes below the melting point and thus through its vapour protects the sintered components alloyed with manganese in the furnace against oxidation also in an atmosphere of hydrogen and nitrogen of low purity ("self cleaning effect, self-reduction effect") because of its high affinity for oxygen. By this way the notion that manganese alloyed steels have to be sintered according to thermodynamics, requiring very high purity protective sintering atmosphere, was disproved. Andrej Šalak's hypothesis of the "self-cleaning effect" has also been experimentally confirmed.

On request of the publisher, together with a co-author he prepared the work - *Sinter Alloying and Properties of Manganese Steels - State of the Art*, 64 pages. This work was published as a chapter in the book "BULK MATERIALS: Research, Technology and Applications", ed. Nova Sciences Publishers, New York, 2009, and in the book ADVANCES in CONDENSED MATTER and MATERIALS RESEARCH, Vol. 7, ed. Nova Publishers, New York, 2010.

The 600 citations were found in articles published in the journals and in Proceedings.

In 2014 Andrej Šalak received a *Letter of thanks* of SAS Presidium as "Merited Worker of the Slovak Academy of Sciences".

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