

## In Memory of Professor Nikolai Tikhonovich Kudryavtsev, a State Prize Laureate of USSR (1901–1979)

Professor Nikolai Tikhonovich Kudryavtsev, whose hundredth birthday was celebrated last May, was a pioneer of the electrochemical industry in our country, one of those who organized and developed the electroplating technology, an outstanding scientist in the field of theory and practice of the metal electroplating. His book *Basics of Electroplating*, written together with V.I. Lainer has run three editions, was translated into English, Chinese, Polish, and Romanian, and is still extensively used by those who work in the field of electroplating. New generations of electrolytes developed in the second half of the 20th century are all based on the fundamental principles of electroplating formulated in this book.

Nikolai Kudryavtsev was born on May 3, 1901 in a village of Kochaki of the Yassenkovo region of the Tula province in the family of a village priest. At nine, he entered a theological college in Tula. After the revolution, in 1918, he graduated from a secondary school in Tula. Since 1919 and until 1926, he studied at the Plekhanov Institute of National Economy and, on graduating from it, got the diploma of an engineer-technologist. Since that time, his professional life had been closely linked with electroplating: the development of new technological procedures and equipment, organization and supervision of electroplating bays and shops, and work at the research and educational institutes. Since 1938, Kudryavtsev worked as an associated professor of the Department of Technology of Electrochemical Industries (TEI) at the Mendeleev Institute of Chemical Technology in Moscow, combining this post with work in the industry. Since that time, his activities had been connected with this institute and interrupted only during the Great Patriotic War. After the war, he became Dean of the Faculty of Technology of Inorganic Substances, and since 1956 till his death in January 1979 had headed the TEI Department. It was during that period that he demonstrated a talent of scientist and excellent pedagogue capable of passing his knowledge to students, post-graduate students, and trainers, and showed a gift of organizer of science and industry. Having a deep insight into technological details of electroplating, he was aware of the trends in this field of science and technology. The research he organized at TEI was facilitated by his friendly cooperation with the Laboratory of Metal Electroplating at the Institute of Physical Chemistry of the Academy of Sciences of the



USSR, then headed by Prof. A.T. Vagramyan. Introducing his ideas into life and organizing research in novel promising directions of electroplating, Kudryavtsev always knew how to ultimately develop them into technological solutions for concrete industrial processes.

His first research work on the production of iron and zinc powders was started as far back as in 1928 at the Karpov Research Institute of Physical Chemistry. In 1949, for a large cycle of fundamental studies, N.T. Kudryavtsev was awarded a State Prize of the USSR.

For a larger part, his studies were devoted to a still important industrial process—zinc electroplating. Kudryavtsev constantly turned to this process during his work at TEI. Zinc-plating of wires and strips from acidic baths, the process he introduced back in 1928, is still used in practice, ensuring high output and stability in adverse conditions of electroplating baths. Later, to find a substitute for cyanide baths, he developed alkaline baths for plating complex-shaped parts and introduced this process at several car plants.

Works supervised by Kudryavtsev and dedicated to the kinetics and mechanism of silver plating were marked in 1966 by an award of the American Electroplating Society—"The Precious Metal Plating Award."

Kudryavtsev have timely understood the prospects of electroplating bright coatings. He was the first in the USSR to study conditions required for the formation of bright zinc, nickel, and copper coatings. As far back as in the 1930s, due to his efforts, aromatic sulfo derivatives were successfully applied as brightening agents in nickel-plating baths and are even now the mandatory components of all modern electrolytes intended for bright and smooth nickel-plating. At present, this electrolyte is used in industry and included into state standards. A detailed study on the role played by the smoothing and brightening agents added to nickel- and copper-plating baths led to the development of new highly effective processes for the deposition of bright coatings with advanced protective and mechanical properties.

Micro- and macrodistributions of electroplated metals on the electrodes were among the central subjects of his research. Kudryavtsev constantly turned to this problem. To estimate the throwing power of electrolytes, he developed calculating techniques and suggested electrochemical cells of ingenious design, which simulated the conditions of industrial electroplating.

Iron-plating and especially chrome-plating are widely used in the modern electroplating industry. However, the low efficiency and environmental hazards, first of all, of the latter process have motivated search for new solutions of this problem. Kudryavtsev was the first in our country to carry out systematic studies on the chrome plating from its trivalent compounds. He proposed some electrolytes that permitted obtaining chromium deposits (first of all, those codeposited with iron-group metals) at a high current efficiency.

The technical progress had required new coatings with unique properties, which could no longer be obtained by depositing individual metals. That was why Kudryavtsev initiated the studies on the preparation of alloys based on nickel, zinc, tin, etc. at TEI. Alloying zinc with nickel and cobalt substantially enhanced its corrosion resistance, whereas alloying tin with lead or bismuth made it possible to avoid spontaneous growth of "wiskers" on tin printed-circuit boards and improve their solderability. For the rubber industry, alkali-tartrate brass-plating electrolytes were developed, for depositing coatings that ensured strong adhesion of rubber to metal parts. In his last years, Kudryavtsev started very promising studies on the chemocatalytical reduction of metals.

His wide knowledge, great experience, and sharp scrupulosity allowed him to outline in his books the essence of problems and convey all the necessary details to his readers in a clear and comprehensive form. This concerns the aforementioned book *Basics of Electroplating*, his earlier study-book *Electroplating*, the book *Metal Electroplating*, and numerous collections of papers, study guides, and hand-books.

Inasmuch as his professional life started in the industry, Kudryavtsev always was in touch with the

engineers, who provided him with new ideas for his fundamental research. In turn, he acquainted them with new achievements in the field of electroplating and technological equipment. For nearly three decades, he was Chairman of the Section of Electroplated Coatings at the Moscow House of Scientific and Engineering Education, a member of the Committee on Corrosion in the State Committee of Science and Technology of the USSR, Chairman of the Committee on Corrosion Protection of Metals in the All-Union Scientific and Engineering Society, a member of the Editorial Board of the journal *Zashchita Metallov* (Protection of Metals).

At present, his pupils head departments in a number of universities in Russia and abroad, run plants' shops and bays, work at various regions in this country and abroad. The ties between them and Kudryavtsev did not break till his death.

Nikolai Tikhonovich was a man of genuine culture. Being always busy and appreciating every minute, he was within reach of his colleagues and always willing to help and give support. His answers were surprisingly brief and clear. He was ready to discuss even the simplest questions. He was averse of rudeness, forgetfulness, and dishonesty. His colleagues and everyone who knew him liked and respected him. He always was in the focus of attention at scientific conferences, meetings, and workshops. In their lectures, the participants often voiced their gratitude and appreciation of his contributions to the development of science and technology, his efforts in introducing new technologies, his help to their research, discussions of results, consultations, and valuable advice.

We always recall Nikolai Tikhonovich when we pass the Kremlin and admire the bright stars on its towers and the clock on the Spasskaya Tower. In the late 1930s, Kudryavtsev headed the electrochemical group charged with a task of gold-plating structural elements of the Kremlin's stars. The group successfully accomplished the task. For more than 60 years, the ruby stars with golden structures enter the unique ensemble of the Moscow Kremlin.

Memory of N.T. Kudryavtsev is alive in his numerous pupils, in those who carry on his scientific and technological researches, in his books, study-books, and papers. Memory of him also lives in his sons. One of them, Professor V.N. Kudryavtsev continues the work started by his father. He heads the Department of Technology of Electrochemical Processes at the Mendeleev University of Chemical Engineering.

This issue of the journal is dedicated to Nikolai Tikhonovich Kudryavtsev. It presents the works of his pupils and successors who developed both his ideas and novel scientific directions in the field of electrodeposition of metals and alloys.

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