

**THE 100TH ANNIVERSARY OF THE BIRTH OF PROFESSOR
CRISTOFOR I. SIMIONESCU – FOUNDER OF EDUCATION
AND RESEARCH SCHOOLS IN THE FIELDS OF NATURAL
AND SYNTHETIC POLYMERS IN ROMANIA**

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This year we celebrate the 100th anniversary of the birth of professor Cristofor I. Simionescu, founder of the Romanian school of natural and synthetic polymers. He was born on 17 July 1920 (at Dumbrăveni, Suceava, Romania). In 1944 he graduated as chemical engineer distinguished with *Magna cum laude* at the “Alexandru Ioan Cuza” University, Institute of Chemical Technology, Iasi, and, in 1948, PhD at the “Gheorghe Asachi” Polytechnic Institute, Iasi. He became Assistant Professor in 1944 and Professor in 1952. He was elected corresponding member of the Romanian Academy in 1955 and full member in 1963.

On this special occasion, we have a possibility to evidence the outstanding contributions brought by Prof. Simionescu in the field of natural and synthetic polymers. The research and education activity in the domain of pulp and paper started in Iasi, as early as 1948, when the first attempt to set up in Bucharest a department in this field failed. That is why, academician Cristofor Simionescu, associate professor at that time, receives the mission to set up in Iasi the department of **Technology of pulp and paper**. Together with one of his

colleagues, professor Vasile Diaconescu, he succeeds in doing this even under the difficult conditions, inherent to any beginning. Later, in 1955, the department will be re-named **Technology of pulp, paper and rayon fibers**. Nowadays, as a result of the evolution in the Romanian industry, the department is named **Paper Engineering**, its main objective being of training higher education specialists for this industrial field.

In parallels with the organization and development of the educational system, the necessity of training the teaching staff and of initiating research activities was a natural consequence. Thus, with professor Simionescu as PhD supervisor, the first doctoral theses were elaborated and publicly defended. The Humboldtian synergy between educational and research activities has become a characteristic of this school, manifested since its beginning. Extensive investigations were launched in the field of chemistry of wood and annual plants, performed by mixed teams from the "Petru Poni" Institute of Macromolecular Chemistry and the teaching staff of the Polytechnic University. The studies carried out provided an impressive volume of data, included in a series of valuable monographs.

It is interesting to underline the importance of these contributions from many perspectives, such as: (1) originality of the approached subjects in relation to what is happening at world level; (2) setting up a data bank to know the potential and biomass reserves with implications in capitalization; (3) recording of the evolution of forest vegetation in relation to the environment-trees, including in their morpho-anatomic structure the influence of the environmental factors over time; (4) study of annual plants and of reed has provided data for the industrial applications developed in Romania; (5) mono- and macro-marine algae are currently hoping to develop renewable raw material resources for biofuels and bioproducts.

Another interesting field courageously approached was that of plant tumors, many papers being published between 1956–1968 (treating topics such as induction, characterization, inhibition, antioxidants). In this respect, the existence of some vegetal tumors in certain woody species (such as plum) was identified and chemically characterized. The chemical changes observed in lignin content led to the idea that the tumor process is propagated through radical reactions, as it was the case of the biosynthesis of aromatic polymers. Starting from this observation, the possibilities of inhibiting the growth of vegetal tumors using antioxidants were demonstrated in the *Solanum lycopersicum* plant infected with the crown-gall tumor.

An extensive cycle of papers has been dedicated over the years to lignin chemistry, materialized, in a first stage, in proposing a structure formula for reed lignin. Studies in this field continued with investigating the reactions of this polymer, the contributions of the Romanian researchers being recognized by their inclusion in programs with national and international participation.

The chemical modification reactions of natural polymers have also been an in-depth area dealt with, materialized in numerous fundamental and applicative contributions. At present, the grafting reactions of natural hydrophilic polymers

have gained great scientific significance, as to conferring hydrophobicity to their processing in blends with synthetic polymers, for composite materials obtaining.

In a research program funded during the global oil crisis (1973), the chemical and energetic potential of vegetal biomass was studied as a renewable source of raw materials, the results obtained permitting the development of a complex model for complex biomass valorization.

From this moment on, new researches have been developed both in Romania and abroad, the concept of complex valorization being defined as **biorefining**, namely obtaining of energy and bioproducts through fractionation of the vegetal biomass.

Another large-scale program tackled the issue of synthetic papers. In this case, too, a lot of scientific information has been accumulated in publications, patents and applicative tests for some paper grades, up to industrial level.

The international recognition of the school of Iasi was confirmed along the 13 international symposiums on **Cellulose Chemistry and Technology**, organized under the chairmanship of academician Cristofor Simionescu since 1961. On the occasion of the 1965 symposium, a group of the scientists in the field entrusted academician Simionescu with the task of setting up the journal **Cellulose Chemistry and Technology** (www.cellulosechemtechnol.ro), published by the Romanian Academy Publishing House. The journal has been issued without interruption over 50 years, even under the most difficult conditions, enjoying the support of the members of the editorial team – well-known scientists all over the world, not only in the field of chemistry and structure of chemical components of wood, but also in synthetic polymers.

As known, the scientific contributions of academician Cristofor Simionescu have been appreciated at both national and international level. Concerning the field of pulp and paper, worth mentioning is the award, in 1976, of the Jubilee Medal of the American Chemical Society, by its Division for Cellulose, on the occasion of the celebration of the USA bicentenary. The medal was awarded to 20 world-renowned personalities of the field who were invited to contribute with review-papers included in a special volume published on this special moment. The medal was handed to academician Simionescu at the Romania – USA Polymer Seminar, held in Iasi in 1976, a manifestation that can also be seen as a recognition of the Romanian school of polymers.

The early interest of academician Cristofor Simionescu for synthetic polymers has been demonstrated by his conference **Aspects in the field of huge molecules**, delivered in the Aula of the “Gheorghe Asachi” Polytechnic Institute of Iasi, on March 16, 1948. Following the reform of education imposed in 1948, the Faculty of Industrial Chemistry of the Polytechnic Institute of Iasi was structured into two sections: Inorganic Industries and Organic Industries. In the latter one, in the academic years 1952/1953 and 1953/1954, the discipline **Macromolecular chemistry**, redefined, between 1960–1962, **Macromolecular**

compounds, was included. Starting with the academic year 1962/1963, following academician Cristofor Simionescu's initiative, the specialty **Technology of macromolecular compounds** begins to operate with a separate curriculum.

Many of the fields of research in synthetic polymers initiated by academician Simionescu have evolved either under his direct leadership or have been taken over creatively by his coworkers (mecanochemistry of polymers, photo- and semiconductor polymers, modification of natural polymers, especially those for cellulose derivatives obtaining, which have opened the way for the creation of supports for the immobilization of enzymes and drugs, origin of life, etc.).

In this respect, the researches performed in the field of mecanochemistry of polymers are remarkable, some of them being appreciated and taken over by foreign researchers.

Mention should be also made of the contributions in the field of photo- and semiconductor polymers, nowadays materialized in the synthesis of some polymers used in the realization of computers and solar energy reception systems.

The reactions of modification of natural polymers, especially those of obtaining cellulose derivatives, have opened the way for the creation of supports for enzymes and drugs immobilization. In this respect, different initiators and monomers were studied to achieve controlled release systems for drugs. Such researches were launched in the 70's, when researchers such as **Robert Langer** (1948) from MIT began to develop systems based on modified polymers to be used in drug delivery for medical applications. Aspects of the field of biocompatible and bioactive polymers were reviewed and developed in many researches.

One of the fields initiated and coordinated by academician Cristofor Simionescu especially dear to him was the origin of life, a domain approached at that time in important schools of scientific research worldwide [*e.g.* **Sidney Walter Fox** (1912–1998), USA].

The team led by Professor Simionescu proposed a model, which involved the synthesis of some precursors of the living matter from the possible constituents of the primary atmosphere of the earth under conditions of cold plasma discharge. In these studies, such compounds have been evidenced, as confirmed by the current researches, that led to the identification of the living matter precursors in the universe.

Recently, two astrophysician teams have identified prebiotic molecules in the vicinity of protostars similar to our Sun in the early stages of evolution. Thus, the presence of **methyl isocyanate**, involved in the synthesis of amino-acids and peptides, was observed (Niels Ligterink-Leiden, Netherlands and Rafael Martin-Domench, Institute of Astrobiology, Madrid – 2017). Supernova SN 1987 ended violently in 1987 and, in the area where explosion occurred, the formyl ion (HCO^+) and sulfur monoxide were identified (2017). The presence of the same mentioned intermediates was also found in the products resulted from the decomposition, in cold plasma, of

the mixtures of methane, ammonia and water, considered as model for the primary atmosphere of the earth.

All these actions constitute examples illustrating that the education and research projects founded by academician Cristofor Simionescu have never been conjunctural, instead they demonstrate his most clear and all-embracing vision over the whole domains of natural and synthetic polymers, while the results attained constitute the basic elements of a long-lasting, sustainable structure nowadays substantiating important areas of common investigation, towards which renewed interest is being manifested in the scientific communities all over the world. Many of the fields dealt with in the scientific research launched by Professor Simionescu have been taken over and are being successfully continued by his coworkers.

It is a great honor to recognize that the 100th anniversary of the birth of Professor Cristofor Simionescu represents an important event for the scientific world and academic community, and an occasion to express our gratitude for his contributions to the progress of natural and synthetic polymers in Romania, appreciated at both national and international level.