

Article <sup>a)</sup>

## ***The Use of Plastics in Soviet Household Appliances. Plastics Rarities from the Collection of the Moscow Polytechnic Museum.***

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**Abstract:** In the first half of the 20<sup>th</sup> century, two main types of plastics were produced in industrial volumes in the USSR – cellulose nitrate and phenolic resins. At first, these materials were used to make household items and some electrotechnical products. The most interesting of them are represented in the collection of the Moscow Polytechnic Museum, one of the oldest science museums in the world, founded in 1872. The first models of home vacuum-cleaners and washing devices with cases made entirely of phenolic resin appeared in the USSR in the late 1940s. While the range of household appliances produced expanded after the middle of the 20<sup>th</sup> century, production of household electric vacuum cleaners, washing machines, and refrigerators continued. To begin with, these novel devices were produced for only a short time. For the curators and researchers of the Moscow Polytechnic Museum, these rare examples are unique and valuable objects for studying and preservation.

**Keywords:** *Phenolic resin, Carbolite, Moscow Polytechnic Museum, museum collection, household appliance, vacuum cleaner.*

### **1. Introduction**

Beginning with natural polymers, historic polymeric materials played an enormous role in the cultural heritage of mankind from very early on.<sup>[1]</sup>

However, 180 years ago, in 1839, this continuous development led to the first semi-synthetic polymeric material, i.e. natural rubber, vulcanized with sulphur,

and in 1868 to the thermoplastic cellulose nitrate (trade name *Celluloid*), developed among other things to replace ivory, used for the manufacture of billiard balls. With respect to consumer goods, cellulose nitrate was suitable for the imitation of rare and expensive natural materials, such as coral, ivory, turtle, amber, mother of pearl, etc. for the manufacture of household

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products like combs, brushes, piano keyboards, toys, buttons, costume jewellery, and educational tools to just name a few. However as a producer good, cellulose nitrate was also very important for the development of technology like photography and moving pictures.<sup>[2]</sup>

In its early stages, casein formaldehyde resin (German trade mark *Galalith*, patented 1897), was likewise used not only for decorative but also for technical applications such as electrical insulators.<sup>[3]</sup>

In 1907, American chemist L. Baekeland developed and patented the first fully synthetic thermoset material. The new pressed phenol formaldehyde resin (phenolic resin), was given the trade name *Bakelite*.<sup>[4]</sup>

The properties of plastics in many respects surpassed those of traditional structural materials - metal, glass, ceramics, wood. Consequently, the fields of application and production volumes of plastics began to increase rapidly.

## 2. First plastics in Russia and USSR

In Russia (from 1922 to 1991: USSR), cellulose nitrate (*Celluloid*) was produced on an industrial scale in the first half of the 20<sup>th</sup> century. The first large factory for the production of *Celluloid* in Russia was built in Leningrad in 1926. At this factory, the cellulose nitrate softener camphor and numerous application goods like nitro lacquer, *Celluloid* films, imitation leather and other artificial and synthetic materials were also manufactured. *Celluloid* was widely used for the production of a variety of household and technical items, such as children's toys, utensils, films, parts of musical instruments, tennis balls, slide rules, and pans for pharmaceutical hand scales etc.. (cf. Figure 1, 2).<sup>[5]</sup>

There were also many small workshops producing articles made of *Galalith* and hard rubber (trade name *Ebonite*). At first, these materials were used to make products that did not require high strength

properties: i.e. household goods and certain electrotechnical products.

Many of them are represented in the collection of the Moscow Polytechnic Museum, one of the oldest science museums in the world, founded in 1872. These objects reflect the first stages in the use of polymeric materials in Russia.



**Figure 1** Dance card ("Carnet de bal"). Cellulose nitrate, metal. Russia, 1895-1896.<sup>[6]</sup>



**Figure 2** Pharmaceutical hand scale with cellulose nitrate pans. Early 20<sup>th</sup> century.<sup>[6]</sup>

Industrial production of the first synthetic plastic in Russia already began in 1916.<sup>[7]</sup> In the little town of Orekhovo-Zuyevo near Moscow, the plant "*Carbolit*" started up production of the phenolic resin *Carbolite*. This plant was the only producer of phenolic resin in Russia/USSR for almost 25 years. Numerous products were manufactured from *Carbolite* at that time. The Moscow Polytechnic Museum holds interesting examples of these such as e.g. storage cases for manicure tools, mini camera cases, and so on (cf. Figure 3).



**Figure 3** “Lilliputian” mini camera, *Carbolite*. USSR, Leningrad, State optical and mechanical plant, 1937-1940.<sup>[6]</sup>

### 3. The use of plastics in Soviet electric appliances

In the USSR, electric household goods began to be produced in the 1930s. First, traditional materials like metal, wood, and textile were used. Only electric plugs and switches were usually made of pressed phenolic resin. Engineers who were looking for options to reduce the mass and size of home appliances offered to test *Carbolite* as a replacement for metal in these products. The choice of this plastic was further justified by its excellent mechanical and dielectric properties.

Electric plugs, switches, razors, different phone and radio cases etc. were widespread. Phenolic resins began to be used for the manufacture of special electric table lamps from the middle of the 1930s.<sup>[8]</sup> Thanks to their charismatic design, originally created in Germany in 1929 as the first plastic lamp by the German Bauhaus teacher Christian Dell,<sup>[9]</sup> these lamps, became ubiquitous in the Soviet union and a real symbol of that era (cf. Figure 4).



**Figure 4** Electric table lamp, *Carbolite*. USSR, Moscow region, Orekhovo-Zuyevo town, The “*Carbolit*” plant, 1950-1959.<sup>[6]</sup>

The first models of home appliances with cases made entirely of *Carbolite* appeared in the USSR during the late 1940s.

First electric vacuum cleaners, washing machines, hairdryers, and refrigerators were produced.

One of them was the hand-held “*Ural-PR-1*” vacuum cleaner. (cf. Figure 5, 6). Its serial production was established at the “*Miaselektroapparat*” plant in 1949 (Ural region of the Soviet Union). The “*Ural-PR-1*” was produced over several years, until 1956.



**Figure 5** “*Ural-PR-1*” vacuum cleaner. USSR, Miass, 1953.<sup>[6]</sup>

It was a small, light, and very comfortable device, accompanied by suction nozzles of different shapes for cleaning various surfaces. Today, only a few examples have been preserved, making the “Ural-PR-1” vacuum cleaner in the museum collection a real rarity.



**Figure 6** “Ural-PR-1” vacuum cleaner, cylindrical *Carbolite* case, engine with impeller, a cotton filter bag.<sup>[6]</sup>

Another innovative apparatus of the time was the household washing vibration device “VSP-2”. (cf. Figure 7)



**Figure 7** “VSP-2” washing vibration device. *Carbolite*, metal, rubber. USSR, Leningrad region, 1957.<sup>[6]</sup>

Having the shape of a mushroom, it consisted of a generator of low-frequency sound vibrations (100 cycles per second) and elastic membranes installed in the *Carbolite* case (cf. Figure 8). People lived in

communal flats and small rooms in the USSR of the 1950s. There was no space to put a large washing machine. But it was easy to store this small washing device. The “VSP-2” apparatus was designed to wash up to two kg of dry laundry and could operate without interruption for one hour. But it was very noisy during operation. These apparatuses were produced for only a short time, meaning they are very rare now.



**Figure 8** Working section of the “VSP-2” washing vibration device: elastic membrane installed in the *Carbolite* case.<sup>[6]</sup>

In general, there are two key periods in the history of production of synthetic plastics in the USSR. The first was the 1950s-1960s when the mainly phenolic resins and other early plastics like cellulose nitrate and casein formaldehyde resins replaced traditional construction materials like metals etc.

The use of plastics in the USSR was characterized by a decreasing use of phenolic resins, and an increased production of oil-based thermoplastics in the second period spanning the 1960s and 1970s. This was due to the discovery and exploitation of large oil fields in western Siberia. In consequence, Soviet mass production of polyolefins, polystyrene, polyvinyl chloride, and other polymers took off, obtained from refined petroleum products and other natural hydrocarbon raw materials. The new polymers were cheaper and technologically more advanced in processing.

The USSR expanded its production capacities for polymeric materials from the 1970s onwards. Simultaneously, the number of household products and devices likewise increased drastically.

The use of thermoplastics allowed a complete change in the design and the appearance of some familiar home devices, for example, table fans, meat grinders, electric hair dryers (cf. Figure 9), mixers and food processors.



**Figure 9** Table turbofan “TV-1”. polystyrene, metal. USSR, 1966-1967.<sup>[6]</sup>

The USSR introduced new models of vacuum cleaners with cases made entirely of plastic in the late 1970s. One of them was the very popular, small-sized “Sputnik” vacuum-cleaner. The case was made of impact-resistant polystyrene, while PVC is used for the flexible hose, equipped with a brush of polyamide (cf. Figure 10).



**Figure 10** “Sputnik” vacuum-cleaner. USSR, Leningrad. The Electrical Household Appliance Plant, 1989.<sup>[6]</sup>

In addition to the traditional vacuum cleaners, the USSR also saw production of portable vacuum cleaner-brushes of the “Veterok” (“Breeze”) series in the middle of the 20th-century. Originally, four models were produced between 1956 and the mid-1990s. The first models “Veterok” and “Veterok-2” had a body made of metal and *Carbolite*, and the last two models “Veterok-3” and “Veterok-4” had a body made of polystyrene. Ostensibly, the dimensions of the body had not changed, but anyone knowing the history of plastics, will immediately attribute model 1 and 2 to the 1950-1970s, and models 3 and 4 to the 1970-1990s (cf. Figure 11).



**Figure 11** “Veterok” vacuum cleaner-brush. The lower part of the body out of *Carbolite*, USSR, Leningrad, The Electrical household equipment plant, 1962.<sup>[6]</sup>

A remarkable and most comprehensive illustration of the history of using plastics in household products is the historical line of cold storage devices, presented in the collection of the Polytechnic Museum. These apparatuses, spanning almost the entire 20th century, changed with the spirit of the times. There were no plastics in the fridges of the early 20th-century – only wood and metal (zinc) (cf. Figure 12).



**Figure 12** Fridge. Metal, wood, insulation material. Germany, early 20<sup>th</sup> century.<sup>[6]</sup>

Such fridges were widespread among urban residents in the first half of the 20<sup>th</sup> century. They were made in Moscow and St. Petersburg, or brought from abroad - mainly Germany.

The first electric home refrigerators in the USSR appeared in the early 1950s. It was the electric refrigerator "ZIL-Moscow", engineered in 1954. The inner side of the door was made of phenolic resin and painted white. There were no cells and shelves on the door. (cf. Figure 13)



**Figure 13** Electric refrigerator "ZIL-Moscow". Metal, phenolic resin, rubber. USSR, Moscow, Automobile plant "ZIL", 1955.<sup>[6]</sup>

The next generation of home refrigerators, such as the "Biryusa", made in 1967, used new types of plastics. Their application allowed engineers and designers to completely update the inside of the refrigerator. (cf. Figure 14)



**Figure 14** Refrigerator "Biryusa". Metal, plastic, rubber, glass. USSR, Krasnoyarsk. Krasnoyarsk Machine-Building Plant named after V.I. Lenin, 1967.<sup>[6]</sup>

The door and interior were lined with plastic panels. On the inside of the door, there were shelves with cells for eggs, cans, and bottles as well as a compartment with a spring door for cheese and butter. All these structural elements were injection moulded out of impact-resistant polystyrene.

The Soviet designers even attempted to make a refrigerator almost entirely of plastic at that time. This could not be realized in the end, meaning that souvenir magnets could still be attached to the metal sides of Russian home fridges.<sup>[10]</sup>

#### 4. Summary

In the Moscow Polytechnic Museum, many other remarkable objects illustrate the history of the use of plastics in home appliances and other devices.

In Russia, the Moscow Polytechnic Museum has one of the largest collections of polymer materials and products of all. The museum collection includes all the main types of plastic objects produced in USSR/Russia from the end of the nineteenth to the beginning of the twenty-first century. It holds unique products from this century of technological development. The tasks of the museum curators involve

choosing pieces, and creating the conditions for their preservation, so that the museum collection is remains as representative as possible, reflecting the various periods of production and use of polymeric materials, both in everyday life and in areas of technology.

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