

## **BAKELITE - The birth of modern plastics**

In 1907, a Belgian scientist named Leo Hendrick Baekeland working in New York, discovered and patented a new revolutionary synthetic substance. His invention, which he named 'Bakelite', was of great technological importance, and led to the launch of the modern plastic industry.

The word 'plastic' originated from the Greek word *plassein*, which means 'to mould'. Plastics can be derived from natural sources. Some plastics are semi-synthetic which is a result of chemical action on a natural substance. Some types of plastics are entirely synthetic, i.e., chemically engineered from the components of coal or oil. Plastics have 'thermoplastic' behaviour, which means that it melts when heated and can then be reshaped like candle wax. Few others have 'thermosetting' characteristics like eggs. They cannot go back to their original state, and its shape does not change forever. Bakelite became the first totally synthetic thermosetting plastic.

The history of today's plastics dates back to the mid 19th century with the discovery of a series of semi-synthetic thermoplastic materials. The need for the development of these early plastics was due to many factors like immense technological progress in the domain of chemistry, along with wider cultural changes, and the practical requirements to discover suitable substitutes for decreasing supplies of luxury items like tortoiseshell and ivory.

Baekeland was interested in plastics from 1885. As a young chemistry student in Belgium, he started his research on phenolic resins - a group of sticky substances produced when phenol (carbolic acid) combines with an aldehyde (a volatile fluid similar to alcohol). He then stopped the subject, however, only returning to it some years later. He became a wealthy New Yorker by 1905, after he made his fortune with the invention of a new photographic paper. While Baekeland had been busy making money, some innovations had been made to develop plastics. The first semi-synthetic thermosetting material was patented during 1899 and 1900 which could be made on an industrial scale. In scientific terms, Baekeland's work in this field does not contribute so much to the actual discovery of the material to which he gave his name, but rather the way in which the reaction between phenol and formaldehyde could be controlled, to make its preparation possible on an industrial level. Baekeland took out his famous patent with the preparation and the essential features on 13 July 1907, which are still in use today.

The original patent was a process that had 3 stages, where phenol and formaldehyde (from wood or coal) were first mixed inside vacuum in a large round kettle. A resin was formed from it known as Novalak, which becomes soluble and malleable when heated. Then the resin was let to cool in small trays until it became hard, and then was smashed and ground into powder. Other substances (fillers) like wood flour, asbestos or cotton were introduced, which increase strength and moisture resistance, catalysts and hexa (a compound of ammonia and formaldehyde which supplied the additional formaldehyde necessary to form a thermosetting resin). The resin was then given time to cool and harden and is again powered for a second time. This granular powder is the raw Bakelite, which can be made into numerous types of solid objects. In the final stage, the Bakelite is heated and poured into a hollow mould with the required shape and is exposed to extreme heat and pressure; and setting its form forever.

From chairs to TV sets the design of Bakelite objects was governed to a large extent by the technical needs of the moulding process. The object cannot be designed so that it was locked into the mould and was tough to extract. A common rule was that objects should move towards the deepest part of the mould, and if necessary, the piece was moulded as separate pieces. Moulds should be carefully designed so that the molten Bakelite could flow properly and evenly into the shape. Sharp corners were not practical so it had to be removed, giving rise to the smooth, 'streamlined' style which was popular in the 1930s. Thick walls take longer to cool and harden. The thickness of the walls of the mould was very crucial - a factor which had to be taken into consideration by the designer to make the most out of the machines.

Baekeland's invention was treated with arrogance by the public in the early years. But it gained unmatched popularity which lasted throughout the first half of the 20th century. It became a spectacular invention for the industrial expansion of the new world. It was described as a material of a thousand uses. Bakelite being non-porous and heat-resistant, was used to manufacture kitchen goods and were advertised as being sterilisable and germ-free. Electrical manufacturers caught on to its electricity insulating properties, and people admired its bright shades of colours, at last, delighted that they are no longer restricted to the wood tones and dark brown colours of the preplastic era. In the 1950s it then became unpopular and was neglected and destroyed in large quantities. Recently, it again gained popularity with more requirements for original Bakelite products in the collectors' marketplace, and museums, societies. People once again appreciated the style and originality of this innovative material.

## Bakelite IELTS Reading Questions

### IELTS Reading Sentence Completion Question 1-5

#### Questions 1 – 5

Complete the sentences below.

Choose **NO MORE THAN THREE WORDS AND/OR A NUMBERS** from the passage for each answer.

- 1 The history of today's plastics dates back to the mid \_\_\_\_\_ with the discovery of a series of semi-synthetic thermoplastic materials.
- 2 In 1907, a Belgian scientist named \_\_\_\_\_ working in New York, discovered and patented a new revolutionary synthetic substance.
- 3 The word 'plastic' originated from the Greek word \_\_\_\_\_, which means 'to mould'.
- 4 A resin was formed from it known as \_\_\_\_\_, which becomes soluble and malleable when heated.
- 5 Bakelite being \_\_\_\_\_ and heat-resistant, was used to manufacture kitchen goods and were advertised as being sterilisable and germ-free.

## IELTS Reading Yes/No/Not Given Question 6-10

Questions 6 - 10

*Do the following statements agree with the information given in the Reading Passage?*

*Write*

**YES** if the statement agrees with the claims of the writer

**NO**, if the statement contradicts the claims of the writer

**NOT GIVEN** if it is impossible to say what the writer thinks about this

6 Plastics cannot be derived from natural sources.

7 Moulds should be carefully designed so that the molten Bakelite could flow properly and evenly into the shape.

8 Baekeland's invention gained popularity in the first half of the twentieth century.

9 Novalak is soluble and malleable when heated.

10 Baekeland didn't realise the bad effects of plastic on the environment.

## IELTS Reading Note Completion Question 11-15

Questions 11- 15

*Complete the notes below.*

*Write **NO MORE THAN TWO WORDS AND/ OR A NUMBER** from the passage for each answer.*

11 \_\_\_\_\_ is a compound of ammonia and formaldehyde.

12 Synthetic plastics can be made from \_\_\_\_\_ or oil.

13 Bakelite had electricity \_\_\_\_\_ properties.

14 Bakelite is sterilisable and \_\_\_\_\_.

15 \_\_\_\_\_ style which was popular in the 1930s