

Subject: Pencil Lead, Electrodes and India ink - how to make

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How does one make pencil lead and India ink in a primitive environment?

The following was copied verbatim from Patent 4,017,451 April 12, 1977

Pencil lead, has heretofore been manufactured by blending graphite or artificial graphite, with a clay binder, grinding the blend with water and kneading it, extruding the wet material so obtained into the appropriate form for a lead pencil, and after drying, baking it at elevated temperatures of about 1,000 degree C and further oil-immersing it. Such a method is complicated for a manufacturing process not only in that it involves a large number of steps but also because close control of the water content at the time of extrusion is required. Moreover, it is necessary to bake the flexible extrudate while maintaining it in a straight line. However, it is almost impossible to bake an endless length of lead continuously. Thus, there is an inherent limitation to the number and types of variations for such a manufacturing process.

Shows details of how pencils are made from clay and graphite and water with baking at 1800 deg F.

<http://www.generalpencil.com/how1.html>

Simple Pencil history and how they are made. <http://www.pencils.com/>

From the Online 1911 Encyclopedia: The pencil leads prepared by the Conte process consist of a mixture of graphite and clay. The graphite, having been pulverized and subjected to any necessary purifying processes, is floated through a series of settling tanks, in each of which the comparatively heavy particles sink, and only the still finer particles are carried over. That which sinks in the last of the series is in a condition of extremely fine division, and is used for pencils of the highest quality. The clay, which must be free

from sand and iron, is treated in the same manner. Clay and graphite so prepared are mixed together in varying proportions with water to a paste, passed repeatedly through a grinding mill, then placed in bags and squeezed in a hydraulic press till they have the consistency of stiff dough, in which condition they are ready for forming pencil rods. For this purpose the plastic mass is placed in a strong upright cylinder, from which a plunger or piston, moved by a screw, forces it out through a perforated base-plate in a continuous thread. This thread is finally divided into suitable lengths, which are heated in a closed crucible for some hours. The two factors which determine the comparative hardness and blackness of pencils are the proportions of graphite and clay in the leads and the heat to which they are raised in the crucible. According as the proportion of graphite is greater and the heat lower the pencil is softer and of deeper black streak. See [http://encyclopedia.jrank.org/PAS\\_PER/PENCIL\\_Lat\\_penicillus\\_brush\\_li.html](http://encyclopedia.jrank.org/PAS_PER/PENCIL_Lat_penicillus_brush_li.html)

Note: Pencil lead made in the above ways will also work for making primitive Carbon Arc Electrodes.

Flexible Lead-pencils are made from:

Graphite and caoutchouc (latex from trees, especially trees of the genera Hevea and Ficus) mixed by titration and the mass is subjected to pressure and rolled into sheets and cut. caoutchouc is a tenacious, elastic, gummy substance obtained from the milky sap of several plants of tropical South America (esp. the euphorbiaceous tree Siphonia elastica or Hevea caoutchouc), Asia, and Africa. Being impermeable to liquids and gases, and not readily affected by exposure to air, acids, and alkalies, it is used, especially when vulcanized, for many purposes in the arts and in manufactures. Also called India rubber (because it was first brought from India, and was formerly used chiefly for erasing pencil marks) and gum elastic. Vulcanization is the act or process of imparting to caoutchouc, gutta-percha, or the like, greater elasticity, durability, or hardness by heating with sulphur under pressure.

India Ink:

One way to make a colloidal graphite is to burn things that make a smoky flame,

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like resins, and to catch the soot on a cool surface. The soot is called lampblack. In Latin, this material was used to make black paints and ink. To make ink, you ground lampblack in a mortar with some gum, gummi, perhaps from the acacia, and a little water. The colloidal graphite was then peptized by the gum, forming a stable sol that was the ink. This recipe was discovered in Egypt when writing on paper was invented, and is now known as India ink. The formula is given in Vitruvius. Ink, paper and writing all came to the west from Egypt. Ink was also discovered in China, where gelatin was used instead of gum. Writing in a different fashion also came from China, with paper made from textile fibres. This excellent ink is still used today in drafting, a survival of a very ancient technique.

see: <http://www.du.edu/~jcalvert/phys/physhom.htm>

Note: Charcoal and coal is not the same as Graphite. These forms of carbon have very low electrical conductivity and are not soft flaky and conductive like graphite. Artificial graphite can be made from these but it is a bit of a complex and hot process using temperatures of about 2500 to 2800 deg C in a carbon dioxide or no air closed container and high electrical currents. There are patents that details this process see separate write up on making electrodes.