

Institute *of Making*

 UCL

Trees



Chewing Gum

Natural chewing gum uses all plant and tree ingredients and some natural sweeteners. The gum base comes from a Sapodilla tree (“sap-oh-dee-yah”), found in Central American rainforests. The farmer cuts into the tree, which will then slowly release the chicle resin into buckets below, similar to maple syrup. It is then filtered and cooked to create the finished gum base. In its current state it is tasteless and needs its minty flavouring added.

Source: http://www.natural-chicle.com/chicle-bases-types#!__chicle-base-contact<http://www.gleegum.com>
<http://www.peppersmith.co.uk/our-ingredients/chicle>

Polyisobutylene (Butyl Rubber): $(C_4H_8)_n$

Man-made gum base, cost effective. Synthetic rubber that starts its life as a liquid gasoline similar to what you have a lighter. A catalyst is then added (this is a secret) which creates a chemical reaction. The resulting product is a clear substance which is really, really sticky and is also tasteless without its added mintyness! Polyisobutylene is also used as a sealant in window glazing.

Source: <http://link.springer.com/content/pdf/10.1007%2F978-1-4020-2292-9.pdf>

The gum base alone doesn't make the gum stretch. It is the process of chewing that essentially brings the product into its more pliable form. When you begin to chew a stick of gum, your teeth push your saliva into the very makeup of the gum. With the introduction of your saliva, the molecular structure changes, and the molecules that were once enmeshed can now sort of slide by one another, making the gum much more elastic and malleable. Without your teeth, the gum wouldn't stretch.

This is known as viscoelasticity which means that gum basically has two distinct characteristics--viscosity and elasticity--that are present at the same time.

Source: http://www.ehow.com/about_4607027_what-makes-gum-stretch.html#ixzz2bU1ZC4jz

Facts

- Chicklet is Cadbury's brand of chewing gum.
- The word 'chicle' simply means 'sticky stuff' in the ancient Nahuatl Aztec language.
- 50 billion sticks a year in the USA alone (around 170 sticks per capita per year).
- To blow the best bubbles, chew until all the sugar has been released and only the stretchy polymer base is left: sugar doesn't stretch, and can cause bubbles to collapse prematurely.

Source: <http://www.scienceinschool.org/print/594>

- Chewing gum elastic competition:

<http://prezi.com/vwtckcfoidz/the-effect-of-chewing-time-on-elasticity-of-gum/>



Maple Syrup

Maple Syrup is graded by its purity, colour and flavour. Different grades of pure maple syrup are harvested at different times of the season which can run from February through to mid-May depending on the weather.

Canadian No 1 (Extra Light) – also known as Grade AA

Produced during the first part of the season this grade is very light in colour, with an extremely delicate flavour but simply delicious over light desserts.

Canadian No 1 (Light) – also known as Grade A

Produced during the first half of the production season, Grade A is light in colour but with a stronger maple flavour than AA. It is ideal for pancakes, waffles and ice cream.

Canadian No 1 (Medium) – also known as Grade B

Harvested from the start of the second half of the season, this is considered in Canada to be the real maple syrup. It has a darker colour and richer maple flavour, making it ideal for hot or cold desserts or even as a dressing for fish.

Canadian No 2 (Amber) – also known as Grade C

As the season progresses, so the colour darkens and the maple taste increases. Canadian No 2 (Amber) is like a full-bodied wine, both rich in colour and flavour, adding a succulent sweetness to any dish. It is perfect for cooking, baking, making marinades and dressings or simply as a tasty, healthy alternative to sugar.

Canadian No 3 (Dark) – also known as Grade D

Produced at the end of the season, D must be for Dark as it is very dark in colour, with an extremely strong taste which is sometimes overpowering. This grade is only sold to food manufacturing companies to use as an ingredient in other products.

Source: <http://www.clarks-uk.co.uk/about-maple-syrup/>

<http://www.whfoods.com/genpage.php?tname=foodspice&dbid=115>

http://en.wikipedia.org/wiki/Maple_syrup

Facts

- Tapped from trees mainly in Canada and America.
- A tablespoon of maple syrup contains 52 calories, that's fewer calories than sugar and honey.
- Excellent source of manganese which provides energy and antioxidants, 22% of our daily allowance.
- A good source of zinc which helps protect the immune system, particularly in children.
- May help to support reproductive health and lower the risk of prostate cancer.
- Contains compounds which could help manage Type 2 diabetes.
- It settles digestion issues such as gas and bloating which can occur after eating processed sweeteners.
- It helps with muscle recovery and keeps bones strong.
- It also includes important nutrients such as iron, calcium and potassium.
- It helps to keep your white blood cells up which help protect against coughs and colds.
- May promote a healthy liver.



Paper Pulp Helmets

A low cost, recyclable, bicycle helmet for use in conjunction with the London Bicycle Hire Scheme. Manufactured from waste newspapers that circulate the London transport network.

Newspapers are collected and blended with water to create a pulp. No bleaching or adhesive is added although an organic and food safe additive is also combined that ensures the helmets water resistance for up to 6 hours of rain. Natural pigments to communicate helmet size is also added.

Helmets are intended for short periods of use and can be disposed of back into waste system. The helmet and strap are fully recyclable and can be re-pulped into a new helmet without any degradation of the material.

Designed by:

Bobby Petersen
Tom Gottelier
Edward Thomas

Source: <http://www.paperpulphelmet.com>

Video : <http://vimeo.com/68492999>



Spoon Carving

After becoming a furniture maker apprentice Barn Carder (aka Barn the Spoon) spent three years travelling and sleeping in woods, searching for wood to carve spoons. He runs one of London's few spoon carving shops based on Hackney Road, where he sits in the window whittling and chipping away at wood whilst passer-by drop in. Barn uses simple tools such as axes and knives to create beautiful functional spoons.

Website: <http://barnthespoon.blogspot.co.uk>

Useful links: <http://www.bbc.co.uk/news/magazine-22467510>

http://www.youtube.com/watch?v=acKcNpDz_Vw

<http://vimeo.com/user10259801>



Tree

This tree will be in the space! It's coming all the way from Zoe's dad's farm, which is pretty exciting.

It's a Scots Pine, approximately 25cm diameter and 15m long. It going to be cut into 4m sections so it can be place inside the space standing up!

Info about the tree itself: <http://www.british-trees.com/treeguide/pines/nbnsys0000004629>

Facts: This is a really interesting link... http://www.treesforlife.org.uk/ilovepine/didyouknow_more.html

Used for pulp and sawn timber products. In Scandinavia, Scots pine was used in making tar, pre-industrial age. Also used as a source of rosin and turpentine. Its a pale brown to red-brown colour. Dry density of around 470kg/m³. Used as Christmas Trees in America during the 50's-80's.





SCOTS PINE

Pinus sylvestris (Pinaceae)



Also called: redwood, red deal, red pine, Baltic redwood, Norway fir, Scots fir, yellow deal, sapin rouge du nord (French), Föhre, gemeine Kiefer (German); also distinguished by origin: Finnish, Swedish, etc. pine

Description

This widely distributed species varies according to its origin. Typically, the heartwood is pale reddish-brown and clearly distinct from the paler, creamy-white to yellow sapwood. The clear contrast between the light earlywood and the darker latewood results in well-defined annual rings. The wood is resinous and knotty, and its texture may be fine or coarse, depending on origin.

Typical dry weight: 32lb/ft³ (510kg/m³)

Specific gravity: .51

Properties

It has low resistance to shock loads, low stiffness, low to medium bending and crushing strength and a very poor steam-bending rating. The wood works well with both hand and machine tools. It saws, planes, moulds, bores, routs, carves, sands and turns well. Gluing effectiveness can vary according to the resin content, and painting, varnishing, staining and polishing are satisfactory.

Grows

Europe, including UK, Scandinavia and Russia

Typical height: 70ft (21m)

Trunk diameter: 2ft (0.6m)

⚠ Possible health risks

Working with pine woods in general can cause allergic bronchial asthma, rhinitis and dermatitis

Seasoning

The wood dries rapidly and well, but is prone to blue sap stain if precautions are not taken. It exhibits medium movement in use.

Durability

Scots pine is not durable and is vulnerable to insect attack. The sapwood is permeable for preservative treatment, and the heartwood is moderately resistant.

Typical uses

Quality grades are used for joinery, furniture, vehicle bodies and turnery. Other grades are used for building, sleepers (railroad ties), telephone poles and piles. It is also rotary-cut for plywood and sliced for decorative veneers.

Laser cutting paper

Peter Callesen

Inspired by Peter we are going to be using the laser cutter to cut pop-up trees, leaves, names.....



Latex

The First Rubber Objects

Natural rubber is produced from the milky-white or yellow sap (latex) of the Pará rubber tree, which used to be found only in the Amazon basin and was notoriously difficult to grow anywhere else.

Although this material didn't appear in the West until the 19th Century, evidence for the use of natural rubber in the service of man dates back to around 1600 BC, when the Olmecs, an ancient civilization of Mexico, used this material for everything from decorative arts to sandals.

The region's most famous artifacts are the large rubber balls that archaeologists believe may have been used in games of ritualistic and religious significance. It is thought that the Olmecs played a game similar to netless volleyball on with these rubber balls. However the price of failure of these games is thought to have been human sacrifice, and the game is thought to have played an important political role in settling border disputes.

Some of these have been found preserved in sacrificial pools of water, and they vary in size from a few inches to a foot; the largest were about the size of a watermelon and weighed 8 pounds.

From that time until the 19th century, natural rubber has had many uses, including the waterproofing of fabrics. However its instability in the face changing temperatures and general fragility made it unsuitable for applications that required durable and reliable materials. Consequently, when leading military figure the Duke of Wellington first commissioned what became known as the Wellington boot, it was made from calfskin leather, not rubber.

In 1855 Charles Goodyear discovered that by mixing sulphur and rubber during the polymerisation process the properties of the resulting rubber were improved, giving a more durable material. This process was later called vulcanisation (after the Roman god of fire) and it is still used today in the manufacturing of rubber - although with improvements.

When the process of vulcanisation was discovered it became possible to harden natural rubber, making it more durable and suitable for the rubber footwear that was originally used by French farmers, taken up by British soldiers in the trenches of WW1 and transformed into safety boots for use in industry in the post-war period with the addition of steel or plastic toe-reinforcement.



3D Printing Wood

A new 3D printing filament called Laywood allows you to print a wood 3d object.

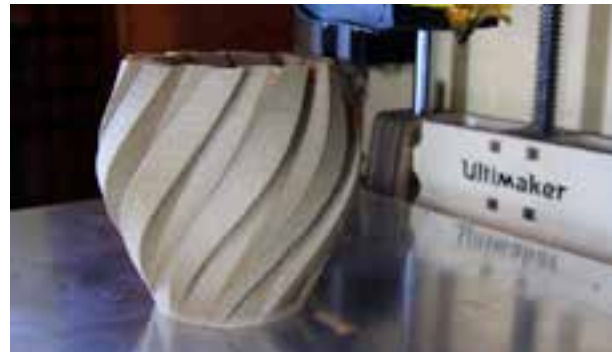
Made with a mixture of wood and plastic its a great faux wood!

With all the normal characteristics of wood, with a faux grain and even a woody smell: you can be fooled! Made in Germany, Laywood is made from 40% recycled wood that's combined with a polymer binder allowing it to be melted and extruded. Creating that grain like effect is a simple change of the temperature at the head which allows the filament to be extruded at different heats thus creating the grain. The lower the temperature creates the lighter pine shades, and the higher temperature creates the darker shades.

The main benefit of this new filament is that it doesn't warp at all during and after the printing process, doesn't shrink and doesn't require a heated bed!

“It actually looks like something between cardboard and a springy MDF. The printed object also really can be painted, much more than with PLA or ABS.” (Jeremie Francois, laywood-D3 maker)

Links: <http://www.geek.com/news/laywood-filaments-lets-you-3d-print-with-wood-1517745/>
<http://www.wired.com/design/2012/11/3d-printer-wood-filament/>



Materials Library

No31: Honeycomb aerospace paper

Greek mythology attributes the first man-made honeycomb to the inventor Daedalus, who is said to have made one from gold using the lost wax method more than 3000 years ago. The geometry of the honeycomb, which occurs naturally in bones and beehives, gives it very good stiffness for its weight, and as a result it is often found in aircraft applications.

This particular honeycomb is (probably) made from a high-temperature resistant aramid paper. Aramids are a group of very strong and heat-resistant synthetic polymers, including Kevlar, which are used in aerospace and military applications for ballistic body-armour, in bicycle tires, and as an asbestos substitute.



No75: Balsa Wood Cores

You may recognise this whiteish-grey, velvety wood from the model-making shops of your childhood – because it is so light and easily cut with a craft knife it's perfect for making model aircraft or for whittling. Because this wood has a lower density than cork it is put to use in other applications where its low density is useful – for example as the core in many surfboards, or in the blades of wind-turbines. In both these applications it is normally laminated with something like a glass-reinforced plastic as, although it is strong for its weight it is still a very soft and fragile material. All of these balsa wood cores in the Material Library collection show signs of wear and tear, and this particular sample shows the damage that can be caused by simply putting pressure on the wood with your fingers.

The tree that produces this wood is the spectacularly fast-growing and short-lived *Ochroma pyramidale*, which can grow to heights of 30 metres in 10 to 15 years, and generally doesn't live beyond 30 to 40 years. These trees are largely found in the tropical forests of South America, with Ecuador being the largest commercial producer of balsa wood. The lightness of the wood can be explained by the fact that it is comprised of large, thin-walled cells. When the tree is alive, these cells are filled with water to give the tree the strength it needs to stand in the jungle. Before it is treated, balsa contains about five times as much water as lignin, but this water is driven off during an extended kiln-drying process so that the wood can be used.



Materials Library

No20: Silicone rubber

Dragon Skin is a milky, moist to-the-touch, membrane-like silicone that is often used in prosthetics, animatronics and orthopaedic and cushioning applications. This material is so stretchy that a mould of it can be turned inside out without risk of tearing it.

This material is supplied in two parts, one of which contains a platinum catalyst which causes the liquid polymer to cure into a solid object. Because silicone rubber flows easily and can be moulded, pressed or extruded using relatively low amounts of energy, it is a useful material for tinkering and making prototypes without specialist equipment. It is generally non-reactive, stable, and resistant to extreme environments and temperatures (from about $-55\text{ }^{\circ}\text{C}$ to $+300\text{ }^{\circ}\text{C}$) so can be used for a huge variety of things, from muffin trays to medical implants.



No325: Latex (Hardened) No332: Latex liquid

When natural rubber is collected from a rubber tree, a milky white substance called latex bleeds from a fresh cut in the bark. The liquid latex is an emulsion containing many micro-sized particles of polyisoprene, and when the liquid dries the particles break down and the polymers bind into a continuous solid. It is the structure of these long chain polymers, and their relationship with one another, that gives rubber the ability to stretch and bend without breaking. The long chains are all intertwined and entangled, and they are quite happy to sit coiled up together due to an electrostatic attraction between them. When rubber is stretched, the individual polymer chains are stretched too, but the attraction between the chains is enough to keep them stuck to one another, such that when you release the rubber, all the chains pull back to their original positions. Latex liquid, as used in craft and design application, is synthetic and made from various types of polymers and elastomers.

Oposite is a mould for making Marigold gloves! This will be in the space for people to have a play with.



Materials Library

No28: Sun-print paper

This light-sensitive paper changes colour from white to a very vibrant Prussian blue when exposed to UV light, and can be used to create photographic reproductions of objects or documents, known as cyanotypes or 'blueprints'.

Whereas black and white photography uses light-sensitive silver compounds in the production of photographic negatives, cyanotyping relies on the light sensitivity of iron salts, typically a solution of potassium ferricyanide and ferric ammonium citrate, to create a 'contact print' in a process similar to photocopying.

These 'sun-print' sheets are brushed with an iron salt solution, and dried in the dark. The object you want to reproduce is placed on top of a sheet, and it's placed in direct sunlight for about two minutes, until the parts of the paper exposed to sunlight turn blue. The object - which can be anything from a plant specimen to a drawing or negative - will stop the light from reaching selected parts of the paper, and a white impression of the subject will be formed on the blue background. The paper is then washed in water, which oxidises the iron salts producing the brilliant blue - or cyan - print that gave the process its name.



No971: Natural Rubber

Natural rubber is produced from the milky-white or yellow sap (latex) of the Pará rubber tree, which used to be found only in the Amazon basin and was notoriously difficult to grow anywhere else. Evidence for the use of natural rubber in the service of man dates back to around 1600 BC, when the Olmecs, an ancient civilization of Mexico, used this material to make large rubber balls which archaeologists believe may have been used in games of ritualistic and religious significance.

When a rubber tree is tapped, a white liquid called latex bleeds from a fresh cut in the bark, the major constituent of which is a small carbon based molecule called isoprene. As the latex dries, the isoprene molecules begin to bind to one another and form long chains called polyisoprene. The long chains are all intertwined and entangled, and they are quite happy to sit coiled up together due to an electrostatic attraction between them. When rubber is stretched, the individual polymer chains are stretched and line-up, and the order of the molecules is increased. This means that the entropy of the system is decreased and represents the force you feel in the rubber. When the rubber is released, all the chains pull back because this increases the entropy of the system.

This particular piece can be seen as part of BBC TV Series 'Secret life of Materials', featuring Institute of Making Director, Dr Mark Miodownik.

<http://www.bbcactivevideoforlearning.com/1/SeriesDetails.aspx?SeriesID=24154>



Materials Library

Wellington Boot

Until the 19th century, natural rubber has had many uses, including the waterproofing of fabrics, but its instability to changing temperatures and general fragility made it unsuitable for applications that required durable and reliable materials. Consequently, when leading military figure the Duke of Wellington first commissioned what became known as the Wellington boot, it was made from calfskin leather, not rubber. However, when the process of vulcanisation was discovered in 1839 it became possible to cure natural rubber, making it more durable and suitable for the footwear that was originally used by French farmers, taken up by British soldiers in the trenches of WWI and transformed into safety boots for use in industry in the post-war period with the addition of steel or plastic toe reinforcement. When supplies of natural rubber were cut off in WWI the search for substitutes began, and the large-scale commercial production of synthetic rubber made from oil became viable. These days approximately 40% of rubber originates from natural sources and the rest from petrochemical sources.

For over 150 years Hunter have been making durable, fashionable and functional wellies, and to top it all off have the seal of approval from the HM The Queen and HRH The Duke of Edinburgh. Hunter wellies are made from 28 pieces of natural rubber, which has been cut to specific spaces and sizes. Often white patches will appear this is the natural rubber, known as blooming, and after a little clean they will be back to normal!

<http://www.youtube.com/watch?v=FwYkVSbrHwI>

<http://www.hunter-boot.com/about-us>



No335: Perished Rubber Bands

These rubber bands are made from natural rubber. An acid, such as formic acid, is added to the latex to make it coagulate, and then it is passed through rollers to remove excess water, and the whole thing is dried. This purified natural rubber is polyisoprene, which is both an elastomer and a thermoplastic. To make the rubber bands, this purified rubber is drawn out into a long tube, which is then cut into slices. Over time, rubber loses its ability to stretch, becoming hard and brittle. This process of perishing occurs because exposure of the rubber to light and air induces chemical changes in the polyisoprene over time.

Materials Library

Wooden Cubes

- 631 - Pine cube
- 634 - Cube of London Underground railway sleeper
- 635 - Iron wood cube, also known as Lignum Vitae
- 642 - Mahogany cube
- 643 - Balsa wood cube
- 645 - Piranha pine cube
- 648 - Oak cube
- 649 - French walnut cube
- 651 - Birch plywood cube, furniture grade
- 657 - Ash 'fraxinus Excelsior' cube
- 661 - Maple Plywood
- Plus more....



Materials Library

Cork

Cork is an impermeable, buoyant material that is harvested primarily from *Quercus suber* (the Cork Oak Tree). Composed of suberin, a hydrophobic substance and due to its buoyancy, fire resistance it is perfect for those wine stoppers!!!!

Portugal is currently has the highest cork harvest, producing around 50% of all worldwide cork.

There are about 2,200,000 hectares of cork forest worldwide; 32.4% in Portugal and 22.2% in Spain.

Annual production is about 300,000 tons; 61.3% from Portugal, 29.5% from Spain, 5.5% Italy. Once the trees are about 25 years old the cork is traditionally stripped from the trunks every nine years, with the first two harvests generally producing lower quality cork.

The tree itself is a slow growing and long lived tree, and have been known to live for 250 years. They thrive in a Mediterranean shrub-land, surrounded by wild olive trees, maquis, stone and maritime pines and deciduous oak species. The Romans first began to harvest the cork bark, of which they discovered that it would float, and used it in fishing nets, as well as sandals.

[http://en.wikipedia.org/wiki/Cork_\(material\)](http://en.wikipedia.org/wiki/Cork_(material))

<http://www.kew.org/plants-fungi/Quercus-suber.htm>



Materials Library

Cinnamon

Cinnamon is a spice obtained from the inner bark of several trees from the genus *Cinnamomum* that is used in both sweet and savoury foods. Cinnamon is the name for perhaps a dozen species of trees and the commercial spice products that some of them produce. The cinnamon tree is a member of the Lauraceae family, which includes the avocado and the California Bay leaf. Only a few of them are grown commercially for spice. Its also an evergreen tree.

It's a fragrant spice which comes from the inner bark of a tropical tree. When dried they curl into quills, these are the shape that you normally see them as. We often use it in foods to add a warm spiced taste, often in Asian, Middle eastern and North African cuisines.

Ground cinnamon has a stronger aroma than the sticks.

If they smell sweet they are not at their best anymore.

<http://en.wikipedia.org/wiki/Cinnamon>

<http://www.bbcgoodfood.com/glossary/cinnamon>

Cinnamomum cassia (The bark in the library)

Also known as Chinese cinnamon.

It's an evergreen tree which originated in southern China, but has been widely been cultivated and is now is southern and eastern Asia.

The buds are also used as a spice, especially in India, and were once used by the ancient Romans.

The tree itself has a greyish bark and hard elongated leaves which have a reddish colour (10-15cm long) and it can grow between 10-15m tall.

Due to a toxic component called coumarin, which can damage the liver, European health agencies have warned against consuming high amounts of cassia.

The difference between Cinnamon and Cassia cinnamon: <http://www.whfoods.com/genpage.php?tname=newtip&dbid=31>

http://en.wikipedia.org/wiki/Cinnamomum_cassia

