Understanding cookware and bakeware starts with an understanding of how foods cook.

**COOKING BY CONDUCTION**

**Conduction**—*Transfer of heat from the heat source directly to the utensil.* Heat spreads across the bottom and is conducted up the sides of the pan from the heat source. Heat is transferred directly to the food mass as the utensil heats. An example of this would be the sautéing of vegetables or stir-frying. For conduction to take place, there must be direct contact between the heat source and the utensil. Top-of-range cookware cooks many foods by conduction, so it is important to that the cookware be made of a good heat-conducting material. There is limited conduction in oven baking because the baking vessel has little direct contact with the heat source.
As you can see from the table of conductivity, glass top-of-stove cookware would be extremely resistant to conduction since glass is a poor conductor (but at the same time, an excellent insulator). There is a benefit to less conductive cookware, however. The more quickly a pan heats up, or conducts, the more quickly it will cool. This is why for long and slow food preparation such as that used with soups, stews and similar recipes, a less conductive pan may be desired, in that it will hold heat for a longer period of time.

### Heat Conductivity of Common Cookware

<table>
<thead>
<tr>
<th>Material</th>
<th>Conductivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>1.0</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.5</td>
</tr>
<tr>
<td>Steels</td>
<td>~0.25</td>
</tr>
<tr>
<td>(coupled conductive bases/sides)</td>
<td></td>
</tr>
<tr>
<td>Iron and steel (single wall)</td>
<td>.16</td>
</tr>
<tr>
<td>Porcelain steels</td>
<td>~.10</td>
</tr>
<tr>
<td>Porcelain irons</td>
<td>~.10</td>
</tr>
<tr>
<td>Glass ceramics</td>
<td>.0025</td>
</tr>
<tr>
<td>Glass</td>
<td>less than .0025</td>
</tr>
</tbody>
</table>

*Also note that conductivity of pan is dependent not only on its material but the thickness of the material. The above conductivities assume equal thicknesses of listed materials.

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**Convection**—Heat transfer by convection requires the movement of air or liquids called *convection currents*. In the cooking process where liquids are involved, convection often modifies or controls the rate of heat conduction. Heat transfer is never by convection alone. In a saucepan, the fluid first begins to heat by conduction. The heated portion rises by convection and is replaced by the cooked portions. As the hot and cool food particles intermingle, the food mass uniformly warms.

Similar to surface cooking, when oven baking, air near the heat source rises and circulates, only to be replaced by the cooler air. The heated air, moving in convection currents, penetrates the food, assisting in the cooking process. Think of the warmth of bath water warming you as you lie in it; or the warm current of air emitted by a central heating system to understand convection.
Induction—Heat is induced into the cookware by an electromagnetic field effect. An electromagnetic coil beneath the ceramic cooking surface creates a magnetic field. This magnetic field passes through the cooking surface to ferrous (iron or steel) cookware, and by its oscillation, induces heat within the pan and cooks the contents. Cookware must have magnetic properties to work on induction cook tops. Non-magnetic metal such as aluminum cannot be used on induction ranges. The heat generated is in the cooking utensil itself as the cook top remains relatively cool since it is non-conductive. While popular in Europe, induction cook tops still account for only a tiny fraction of cooktops sold in the U.S. and Canada.

The induction unit is extremely energy efficient since almost no heat or energy is wasted beyond the edge of the pan and because heating stops when the pan is removed.

Radiation—The transfer of heat by electromagnetic waves. Radiation does not require direct contact with a heat source, liquids or air. Like sound and light, radiation is emitted in waves. Radiation is the reason you can feel hot even on a cool day when you are in direct sunlight.
The heat source in a broiler or an oven produces heat waves. These heat waves are radiated to the food mass thus penetrating and heating. In a conventional oven, over half of the heat is radiant energy (the rest is by convection currents with some added conduction). The transfer of radiant heat relies on the ability of a utensil to absorb radiant heat energy. Dark or blackened surfaces soak up radiant heat, while shiny, bright surfaces reflect heat. Many baking recipes reduce cooking time for dark bakeware.

Microwave—*Heat transmitted by electromagnetic waves for cooking*. Microwaves are very short in length radio frequency waves and are produced by a special generator in the oven called a magnetron. The waves' frequency is tuned to the vibrating frequency of water. These waves are then distributed throughout a metal cavity and in some ovens, the food rotates on a revolving shelf.

Microwaves are sources of energy, not heat. When the waves are absorbed by the water molecules within food, the energy is transformed into heat and bakes and roasts food. Microwaves penetrate ¼ to 3 inches into food, cooking from the inside to the outside on all surfaces.

Microwaves reflect from all the metallic walls in the oven and penetrate the food from all angles, passing directly through the utensil. For this reason, glass, ceramic, plastic and paper are used as cooking utensils in microwave ovens. Metallic cookware reflects the microwaves away from the food and can cause arcing that may damage the oven’s electronics. Some microwave cookware contains a safe combination of plastic and metal to give controlled cooking. In choosing microwave cookware, don’t assume that all plastics are microwave safe. Some may melt at low temperatures and, in others, chemicals within the plastic compounds may be liberated when the plastic is heated.
Materials affect the performance and cost of cookware and bakeware

ALUMINUM

Properties of Aluminum

One of the reasons aluminum cookware is so popular is that it is an excellent conductor of heat. Because of this quality, heat spreads quickly and evenly across the bottom, up the sides and across the cover to completely surround the food being cooked. Aluminum frying pans are particularly popular with consumers in that they help sauté and fry foods quickly. Aluminum is a lightweight metal, about one-third the weight of steel, so in the kitchen, it means that a sturdy aluminum pan is also easy to handle. Aluminum is used for both top of stove cookware and bakeware. Aluminum also does not rust.

Aluminum is also the third most abundant element in the earth’s crust. In nature, aluminum is always found in combination with other materials. An ore called bauxite is our most common source of the metal. Bauxite contains a greater percentage of aluminum than do other ores, and the metal can be extracted more economically. Manufacturing Processes

Aluminum cookware is manufactured principally by the following methods: stamping, drawing and casting. Stamping or Drawing: In the stamping or drawing method, flat sheets or circles rolled to the desired thickness are placed on a press. The press then forms the sheet metal into the desired shape. Afterward, both inside and outside finishes are applied, and appropriate handles and knobs are attached.

Casting: Molten aluminum is poured into molds specially designed for each different cookware utensil. These molds allow the thickness of the cookware to be strategically varied in different areas of the pan for maximum cooking efficiency. For instance, the pan bottoms can be made extra thick for superior heat absorption and the pan walls can be slightly tapered to help create circular heat movement up and down the pan. When the aluminum cools, the mold is opened and the cookware is removed. Cast aluminum utensils are often heavier and thicker than stamped utensils. The bodies of all aluminum utensils are made in one piece so that there are no seams or hard-to-clean crevices.
Generally the gauge or thickness of the aluminum utensils is one feature that determines its quality. The heavier the gauge (thickness), the more durable—and more costly—the utensil. For this reason, the intended use of the utensil should be considered when purchasing. Gauge is usually described by a number, the smaller the number the thicker the aluminum. For example, eight (8) gauge aluminum is thick (.125 inch); twenty (20) gauge aluminum is thin (.032 inch).

**Finishes**

Aluminum utensils are manufactured with a wide variety of finishes. Stamped and drawn utensils may have exterior finishes of polished natural aluminum, chrome plate, anodized (with or without color), porcelain enamel coatings, nonstick coatings or colored organic coatings (acrylics, polyamides, etc.). Usually bottoms have a satin finish or are porcelain enamel coated; both finishes help absorb heat. Cast aluminum utensils may have exterior finishes of colored porcelain enamel coating, polished, hammered or velva-glazed natural surfaces, colored organic coating, or hard-coat anodized surfaces.

The inside finish on aluminum utensils may be a natural finish, “sunray” or “spun” finish, high polish finish, hard-coat anodized finish or nonstick coating.

A majority of aluminum cookware is non-stick coated. You can learn more about these interior finishes later in this course.

**Use and Care**

New aluminum utensils require washing in warm sudsy water to remove any residual manufacturing oils.

After use aluminum utensils, like most cookware, should be allowed to cool before washing or soaking. This is a simple safeguard against warping, as well as preventing accidental burns in handling. Drying immediately after washing will help preserve their appearance. Utensils should be washed each time they are used.

Undissolved salt allowed to remain on an aluminum surface may cause pitting. Consumers should add salt to liquid after it reaches the boiling point and stir to dissolve it completely. Acid or salty foods should not remain in aluminum or aluminum-finished utensils for long periods of time, because this may cause pitting.

Because it combines easily with other natural elements, aluminum may stain when it contacts minerals in water and foods. Automatic dishwashing may increase the amount of staining when the high heat of the drying cycle is added to minerals naturally present in water and the chemicals used to purify water. For that reason, hand washing may be preferred to preserve the attractive finish of aluminum utensils.
Utensils with coated exteriors and interiors may be washed in automatic dishwashers. However, care should be taken when loading them into the dishwasher to avoid marring or scratching the coating.

Stains and discoloration that may appear on aluminum utensils can be removed by boiling a solution of two to three tablespoons of cream of tartar, lemon juice or vinegar to each quart of water in the utensil for five to ten minutes. Then lightly scour with a soap-filled scouring pad. Cooking acidic foods such as tomatoes or rhubarb will remove the stains naturally without affecting the cooked food product. To remove stains from the aluminum exterior, use a nonabrasive cleanser.

Cooking tools made of wood, plastic, or smooth edged metal are recommended for use in aluminum utensils, particularly those with non-stick interiors. Sharp-edged tools such as knives, masher and beaters may scratch aluminum. Check the manufacturer’s recommendation.

**STAINLESS STEEL**

**Properties of Stainless Steel**

Stainless steel cookware and bakeware is exceptionally durable. Once stainless steel has been stamped, spun or formed into utensil shape, it takes an extremely hard blow to dent it. Its attractive finish won’t corrode or tarnish permanently, and its hard, tough, nonporous surface is resistant to wear. Extremely smooth and scratch resistant, stainless steel utensils take an excellent polish.

Top-of-the-range cookware, bakeware, pantryware, tools and other equipment are frequently produced in stainless steel, which eases the work of homemakers.

Like other steels, stainless steel is an alloy—a combination of iron and other metals. What makes it different from other steels, however, is that it contains at least 11 percent chromium. It is chromium that makes steel “stainless” all the way through.

Stainless steel may also contain other elements, such as nickel, molybdenum, columbium or titanium. These materials can contribute special hardness, high temperature resistance, and resistance to scratching and corrosion to the finished stainless steel alloy.

Sometimes you’ll hear a shorthand way of describing stainless steel, such as “18/10” or “18/8”. The first figure indicates the percentage of chromium contained within the stainless. The second number is the percentage of nickel. Nickel is an alloying element used in steel to
increase its ductility, or its ability to be formed. Both of these elements are very expensive compared to regular steel, hence the higher costs of stainless steel.

**Manufacturing**

Stainless steel bakeware utensils are usually fabricated of solid stainless steel. On the other hand, top-of-range stainless steel utensils are generally made by combining stainless with other metals, usually aluminum, copper or carbon steel. The other metals improve the utensil’s heat conductivity. Various manufacturing processes are used to combine stainless steel with these other metals. The resulting combinations are described as two-ply, three ply, threeply/ bottom clad, five/ply bottom clad and five-ply, seven-ply and even nine-ply, depending on the manufacturer and the desired characteristics of the cookware.

Two-ply utensils commonly have a stainless steel interior with another metal on the exterior. In a few instances, this arrangement is reversed with the stainless steel on the outside and a non-stick surface applied to the interior.

Three-ply utensils have stainless steel on both the inside and outside surfaces with a layer of copper, carbon steel or aluminum forming the core.

Bottom clad utensils are formed with solid stainless or three-ply, and copper is plated to the bottom or aluminum is applied to the bottom by casting, bonding or metal spraying. Five-ply/bottom clad utensils are made by the three-ply process, with two clad layers on the bottom. Five-ply utensils are made with stainless steel on both the inside and outside surfaces with three layers of aluminum or other metals forming the core. In the actual manufacture of stainless steel utensils, the metal’s versatility permits it to be formed into a wide variety of attractive and functional shapes, limited only by the imagination of the designer or the desires of the consumer.
Finishes

Appearance is an important consideration in the selection of cooking utensils. A choice of high polish or satin finish is normally available on stainless steel ware. Either of these attractive finishes blends well with all colors and periods of kitchen décor. Also, to meet decorator demand for color in cookware, manufacturers are producing cookware with porcelain enamel exteriors on stainless steel. But the cooking surface is most often stainless steel, where ease of cleaning and protection of food quality are most important. There are some stainless steel utensils with nonstick interiors. The preparation of stainless steel for nonstick finishes is a complicated process, due to the hardness of the steel and its very smooth finish. Additionally, it takes more time and energy to cure the nonstick finish in stainless steel due to its less-conductive nature.

Use and care

Before using a new stainless steel utensil, wash the utensil thoroughly in hot sudsy water to remove any manufacturing oils and polishing compounds. Stainless steel is one of the easiest materials to clean and to keep clean. Washing by hand in hot sudsy water or in a dishwasher usually is the only requirement for keeping stainless utensils bright and shiny. Prompt drying will prevent water spots.

To remove burned-on foods, soak and wash in hot sudsy water. Light scouring with a non-abrasive household cleaner and a nylon scouring pad or a commercial stainless steel cleaner will removed stubborn burns on the interior surfaces. High heat may cause a mottled, rainbow-like discoloration commonly called “heat tint”. Cooking certain starchy foods—such as rice, potatoes or peas—may cause a stain on the inside of the pan. Both of these can be removed easily with any one of a number of readily available stainless steel cleaners. Undissolved salt will “pit” steel surfaces. Consumers should add salt to liquid after it reaches the boiling point and stir to dissolve completely. Do not allow acid or salty foods to remain in stainless steel for long periods of time.

With normal use, a stainless steel utensil will not dent, warp or chip. It thrives on exposure to air, so it is an attractive utensil to display in the kitchen.

PORCELAIN ON STEEL and CAST IRON

Porcelain enamel has served the needs of mankind for centuries. The exact time and place of its origin are not know, but museums throughout the world contain many examples that are older than two thousand years. These ancient artifacts remain as bright, clean and well defined as the day they were created.
Originally porcelain enamel was an artistic medium for making fine jewelry and, even when it was used to make a functional object such as an urn or small box, it was invariably fashioned in painstaking, handcrafted designs. For centuries porcelain enameling developed as an art form, with only gold, silver, copper and bronze used as its base metal.

Then, in 1830, a Bohemian craftsman found he could create a permanent, smooth, glassy surface on cast iron by dusting the red-hot metal with dry, powdered porcelain—and a new era dawned. From that time on, porcelain enamel became a utilitarian as well as a decorative finish.

Porcelain enamel is essentially a highly durable glass which, with coloring oxides and other inorganic materials, is fused to metal at extremely high temperatures. It first found its way into the kitchen as a decorative finish for wood-burning ranges and cast iron utensils. Later, when techniques were discovered for applying it to sheet steel, it became a standard coating for coffeepots, roasting pans and saucepans.

**Manufacturing**

In the manufacture of cooking utensils, porcelain enamel is applied after the metal is formed into its final shape. While porcelain can be applied to aluminum, and stainless steel, the most common substrate is steel followed by cast iron. It is one of the most versatile finishes, offering virtually an unlimited range of colors and design effects. Today’s colors included many shades of reds, greens, blues, yellows and oranges in addition to the traditional “speckled” pattern. There are also decorative porcelain decals, mechanically applied that have the same scratch and stain resistant qualities of the regular porcelain coating.

**Use and care**

Aside from the variety of colors and designs available, the chief recommendations for porcelain enamel are its stain and scratch resistance, its immunity to fading and peeling, its chemical resistance, and the fact that it will not pick up food odors. Porcelain enamel utensils can be used for cooking, baking, serving and storing food. Do not use porcelain enamel utensils over high heat for a prolonged time; extreme high temperatures may cause the porcelain to melt. Additionally, consumers should be careful in using porcelain on metal pans on ceramic or glass cooktop surfaces. Should the pan boil dry the glass coating can adhere to the cooktop, resulting in a crack when the pan is removed.

Cleaning porcelain enamel is easy: just wash in warm sudsy water, using a sponge or cloth. Burned on foods or other stubborn stains can be removed by soaking or by using a non-abrasive cleanser and a nylon or other non-abrasive scrubber. All porcelain enamel utensils are safe in modern dishwashers.
CAST IRON

Properties of cast iron

The most important properties of cast iron are its heat retention and heat distribution. It is also extremely durable. Properly cared for, cast iron will last for generations. Considered by professional chefs to be precision cooking tools, quality cast iron utensils enable precise control of cooking temperatures. Its heat retention qualities allow for even cooking temperatures without hot spots.

Cast iron cookware isn’t pure iron. Other materials, such as carbon and phosphorus, are mixed with the iron to produce proper hardness and durability. Iron with impurities included in it can heat unevenly and crack. Evidence of poor metal mixes include discoloration of the cast iron, striations or smooth bright spots of “white metal”.

Cast iron is currently used for utensils that include skillets, roasters and Dutch ovens, broilers, griddles and some specialty items, such as muffin and corn bread pans. These utensils are excellent for browning, frying, stewing and baking foods.

Manufacturing

Cast iron cookware is produced in a sand-cast process. Quality cast iron requires sand molds made under high pressure so that their shapes can be precisely controlled. In addition to careful attention to the metal used in cast iron, the manufacturer must also control the components of the sand, which include clay, and water. Patterns are pressed into the sand and the molten iron is poured in to the resulting cavity. As the iron cools to its solid state and becomes a cooking utensil, the sand mold is broken apart. The sand is cleaned off the utensil. It is then smoothed and packed for shipment.

Use and care

Natural cast iron utensils should be seasoned before using. After washing the utensil with warm water, dry with a towel and apply a thin coat of vegetable oil and place in a 350°F oven for about an hour and let cool. Over time, the utensil will darken to a black patina, a lasting, nonstick finish. Some cast iron is available now in the market that has a true seasoned finish installed at the factory. Buyers should recognize that what some manufacturers claim as a preseasoning is nothing more than wax coating designed to keep the product from rusting before sale. At least once manufacturer has perfected a preseasoning that results in a “ready to cook” surface similar to that done by the consumer.
Natural cast iron utensils should never be stored with the cover on, as this might cause “sweating” and consequent rust damage. Store these utensils in a dry place.

Cast iron utensils with porcelain enamel interiors do not need seasoning. Hot sudsy water and thorough rinsing will keep them clean and shining.

TINPLATE

The genealogy of tinplate in the kitchen can be traced to ancient times. Tin was widely used in Egypt, although it was not found there. Daring Phoenician sailors ventured to the British Isles, then known as the Cassiterides or Isles of Tin, to obtain this precious metal. Tin plating—the process of plunging plates of iron into molten tin—was discovered in Germany during the 16th century. The secret of using tin as a protective coating for metal was brought to England about 1670.

In our age of new concepts in materials and fabricating methods, tin-plate steel still plays a fairly minor role in the baking industry. Many commercial baking utensils are made from tin-plated steel because it is durable and possesses excellent baking qualities. The consumer market for this type of merchandise has also somewhat less important over the years with the introduction of coated carbon steel bakeware.

Very little care is required in using tin-plate bakeware. This steel-based material is highly resistant to denting and scratching. Tinplate provides the necessary protection that helps the steel resist rusting and staining, although in humid climates the underlying steel can rust if the coating cracks or is otherwise disrupted. A light application of oil or grease will prevent this.

GLASS, CERAMIC AND GLASS-CERAMIC

In the twentieth century, heat-resistant glass and glass-ceramic materials were developed. Like ceramic materials, they meet the need for attractive ware used for mixing, cooking, serving and storing. Major features are attractiveness, one-dish convenience, and inert, non-porous surfaces that won’t absorb food odors and flavors.

While most are very rugged, they can break under impact. However, some glass, ceramic and glass-ceramic cookware manufacturers warranty their products against thermal breakage, and offer free replacement should the ware break in normal use within the warranty conditions.
Heat-resistant glass cookware may be made of clear or tinted transparent material or opaque white (commonly called “opal” glass). Glass-ceramic cookware may be white or transparent and tinted. Ceramic cookware is available in white or a variety of colors.

Properties of glass, ceramic and glass-ceramic

Heat-resistant glass can be used for storing, cooking and serving. Some pieces can be used on the rangetop, while others are suitable only for the oven. Those designed for baking can be taken from the refrigerator and put into preheated ovens after the utensil reaches room temperature. As a rule, they should not be used on the stove top or under the broiler.

Heat-resistant glass stove top products should usually be used with a wire grid on an electric range but should never be taken from the refrigerator or freezer and placed directly on a hot stove’s element. Similarly, sudden cooling may be harmful to glass cookware. Hot glass cookware should not be allowed to come into contact with wet countertops, nor should they be placed in water while they are still hot.

Some ceramic cookware is made of heat-resistant materials that can go from the freezer to a hot oven or microwave. None is suitable for top-of-range or broiler use. Like glass cookware, ceramic cookware holds heat for a long time while providing the additional benefit or an attractive serving dish. Ceramic cookware is available in a wide variety of shapes, colors and designs.

Among the most thermally shock-resistant materials ever developed by man, glass-ceramic is a true spaceage material. It was first used in rocket nosecones because the glass-ceramic material could take the extreme temperature changes encountered in their supersonic flight from the earth’s surface into outer space and back. Glass-ceramic cookware offers wide food preparation versatility. It can be used for stove top cooking and is excellent for roasting, broiling or baking---in the conventional or microwave oven. It can go directly from the freezer to the stove top, broiler or hot oven. Glass-ceramic cookware can be immersed, hot off the stove, into sudsy dishwater for easy cleanup.

Manufacturing

Glass is a non-crystalline material manufactured by melting a combination of raw materials including sand, soda ash, limestone, feldspar and borax. The glass used in cookware is normally melted in a large refractory furnace or tank at temperatures exceeding 2000° F. A small portion of the molten glass is drawn out of the tank and is blown or pressed into a mold. The mold essentially cools the glass, causing it to solidify. Following forming, the glass article is cooked to room temperature on a schedule specifically designed to insure the development of the desired heat-resistant characteristics.
Glass-ceramic is a special glass composition that is melted and formed like heat-resistant glass. Following forming, the articles are subjected to a special heat-treating schedule resulting in the development of a fine crystalline structure throughout the article. It is this crystalline structure (which may be transparent or opaque) that gives the glass-ceramic its unique performance characteristics.

Ceramic cookware is manufactured from a mixture of water, clays, fluxing minerals (often feldspar) and finely ground sand. The particular forming methods depends largely on the water content of the mixture. A high water content (relatively liquid solution) permits casting of the ware in a mold. Lower water content results in a plastic mass that can be forced into the desired shape by a variety of methods.

After forming, the ware is dried and fired (subjected to temperatures in excess of 2000° F) in a ceramic kiln to bond the components of the “body” together. Following this initial firing, the surface of the ware is coated with a glaze that, upon firing in a second ceramic kiln, develops a smooth nonporous surface much like glass. For glass and ceramic cookware with nonstick interiors three layers of nonstick coating are applied to specially prepared interior surfaces and then cured at approximately 800 degrees F.

**Use and care**

Ceramic, glass and glass-ceramic materials are excellent retainers of heat. Baking dishes and casseroles made of these materials hold the food’s heat long after it is removed from the oven. It is usually recommended to use these items at slightly lower oven temperatures for a shorter length of time because the covered cookware continues to cook foods even after it’s been removed from the oven. A rule of thumb is to reduce the recommended oven temperature about 25 F (14 C).

Check the manufacturer’s recommended care and use instructions before using any glass, ceramic and glass-ceramic bakeware. These items are usually cleaned with hot sudsy water and soaked if food has been burned on the item. Avoid knives, sharp kitchen tools, scouring pads and abrasive cleaners so that surfaces retain their original smooth finish. This is especially important for ovenware with nonstick interiors. Nylon and plastic scrubbers are acceptable for stubborn sticking problems.

**PLASTICS**

Since the mid 1970’s, space-age technology has led to many new developments and improvements of plastic materials. Plastic materials now have significantly improved durability and heat resistance leading to their use by manufacturers for ovenware and bakeware.

Plastic ovenware includes a broad category of materials with widely different characteristics. Many shapes, sizes, colors and designs of plastic ovenware are available today. Some shapes
are specifically designed for small, compact microwave ovens, while others are made to accommodate certain foods.

**Properties**

The family of materials used in plastic ovenware provides a number of unique features not necessarily found in the many plastic household items used for serving, storing or packaging. The plastic material used for plastic ovenware is one of three kinds: thermoset plastic, thermoplastic or silicone.

The thermoset plastic materials used for plastic ovenware have a high heat resistance, which make them suitable for use from the freezer to the microwave, convection or conventional oven. An example of a thermoset plastic material is fiberglass-reinforced polyester. This type of ovenware is rigid and consequently will retain the original ovenware share, with temperatures of 400°F/204°C.

Thermoplastic materials for plastic ovenware can be taken from the freezer to the microwave oven to the table. The thermoplastic category includes a number of special compositions for ovenware, all of them considered lightweight and impact-resistant. Some commonly used thermoplastic ovenware materials include polymethylpentene (TPX), polycarbonate and polysulfone.

Silicone is an especially high-heat resistance plastic that can be used for bakeware and is usually safe up to oven temperatures of 450 degrees. Silicone pans, unless wire reinforced, usually must be supported on an oven proof pan when placed in the oven.

All of the thermoset, thermoplastic and silicone ovenware products are dishwasher safe, stain-resistant, breakresistant and easy to clean. These unique characteristics have increased the popularity of plastic ovenware and continued to improve the acceptance of plastic for cooking.

**Manufacturing**

The thermoset plastics are compression molded by using a predetermined weight of material which is either formed or compressed into a slug or pill and is placed in the mold when the mold is in an open condition. The mold then closes and heat and pressure are applied to this plug which forces the resin into all areas of the cavity as it compresses the material.

The thermoplastic or injection molded materials are formed in an injection press in which the material passes through a heated barrel, reducing it to a liquid which is then forced under pressure into the mold itself. The mold is then cooled. Subsequently, the plastic is also cooled and solidified. The parts are then ejected from the mold. Silicone is molded in a similar fashion.
Use and care

Before using any plastic ovenware, check the manufacturer’s carton, labels and booklets for special instructions. Wash the utensils thoroughly in hot sudsy water before first use.

All plastic ovenware is easy to clean in the dishwasher or by hand washing. However, all ovenware requires extra cleaning effort if food is allowed to burn. In such cases soak the plastic ovenware in soap and water, then remove the food with a nylon or plastic scrubber. In order to avoid damage to the surface, do not use an abrasive cleaner, scouring pads, strong solvents or sharp kitchen tools.

New plastic ovenware with nonstick coatings can be used in conventional, convection and microwave ovens. Convenience and versatility are highlighted. The nonstick-coated ovenware goes safely from oven, to freezer, microwave and table.

STEEL

Carbon steel is used chiefly in the manufacture of bakeware. For top of stove use, carbon steel is typically found in imported woks and small frying pans. One of carbon steel’s most important qualities is its inexpensive price.

Carbon steel that is not covered with a factory coating or finish, must be seasoned with oil, just as raw cast iron is, in order to prevent rusting. Such oil seasonings cannot be cleaned in home dishwashers. Most carbon steel, if it is not coated, will have a black oxide finish. While this is attractive it doesn’t offer significant resistance to rusting.

On the other hand, carbon steel, coated with today’s high performance coatings, (so long as their integrity is not compromised) is widely used for bakeware. The dark coatings absorb oven energy well and allow for the use of lower baking temperatures and even baking results.

Carbon steel cookware and bakeware may be produced by stamping, drawing or by folding.

COPPER

Copper, alone or in an alloyed form, has been used in cooking utensils almost since the dawn of history. Copper’s uniform heat conductivity makes it a good material for top-of-range cooking because the heat is rapidly distributed evenly. This property also enables copper serving utensils to keep foods warm and palatable.
Copper cooking surfaces are usually lined with tin, stainless steel or coated with a nonstick finish because foods left directly in contact with uncoated copper may become discolored. The discoloration tends to detract from the food’s eye appeal. Additionally, raw copper pans should never be used to cook acidic foods since copper salts which are poisonous can be produced.

An electrolytic process that deposits copper on the bottom of a stainless steel utensil utilizes copper’s superior heat distribution. Another manufacturing process bonds or laminates copper to stainless steel and other metals. A core of solid copper sandwiched between two layers of stainless steel is another way copper is used to distribute heat uniformly.

**Use and care**

Copper can be easily polished with various commercial copper cleaners. A mixture of flour, salt, lemon juice and ammonia or a mixture of vinegar and flour are two other methods of keeping copper utensils shiny. After cleaning, wash in sudsy water, and rinse before polishing with a soft, clean cloth.

Tin linings may wear off with frequent use; the utensil can be retinned.
Buyers’ Learning Tools

Unit Three:
Nonstick Finishes and Cookware and Bakeware Metal substrate

Consumers buy more nonstick cookware than any other kind. Here’s what’s important about it.

**Two Major Types of Nonstick Coatings**

**Silicone and Silicone Polyester formulations.** These organic-resins are typically applied to bakeware almost exclusively. They are not designed or formulated to withstand the direct high heat that cookware endures on top of stoves. They are designed to release high sugar content baked goods easily and to be dishwasher safe. In general silicone nonstick finishes are less costly than fluoropolymer based finishes.

**PTFE or Fluoropolymer formulations.** These nonstick coatings are almost exclusively found on cookware used on top of the stove. The active ingredient in the coating is a compound known as polytetrafluoroethylene, a waxy solid that is the most slippery substance yet discovered—more slippery than even wet ice. This compound is what gives fluoropolymer cookware finishes their ability to release foods.

**Ingredients of a nonstick coating.** For both silicone and fluoropolymer nonstick coatings there are at least four and sometimes five major ingredients:

1. A resin or binder that adheres to the pan surface
2. A pigment to color the coating
3. The release agent—either a PTFE or silicone compound
4. The carrier—either an organic solvent or water then “carries” the ingredients but which evaporates when the coatings is cured at high heat.
5. Optional reinforcing agents to provide wear protection

**Coatings or layers**

Coatings can be from one to three coatings in thickness. Most can also be reinforced for additional wear protection. As you can readily understand, multi-coat systems are more costly than one or two coat systems.
In a one coat system the binder, pigment, release agent and the carrier are all combined in a single liquid that is applied to the pan and then cured at a high temperature.

Two coat systems have a primer applied followed by a second coat with a higher percentage of release agent.

Three coat systems have a primer, a mid-coat with additional fluoropolymers to enhance the adhesion of the primer to the mid-coat and the mid-coat to the top coat and a subsequent top coat. Between each of the multiple coatings, the pan is run through a “flash-off” or drying step before the final cure.

Three coat systems can also be reinforced. There are two basic types of reinforcement

**External reinforcement**: This is typically done by spraying the surface of the pan with molten stainless steel to provide greater surface area for the coating to adhere to.

**Internal reinforcement**: This is usually accomplished by adding tiny particles of a hard substance to the primer and mid-coat. The final, topcoat of a three coat finish is not usually reinforced. This provides resistance to wearing while maintaining optimum release characteristics.

**Cookware materials and nonstick**

Most aluminum cookware has a nonstick finish applied. Aluminum is easy to prepare and its conductivity make the curing process fairly quick and inexpensive. On the other hand, stainless steel is more difficult to coat with nonstick coatings. The surface usually has to be extensively prepared to accept the nonstick coating. Stainless is less conductive than aluminum so cure times are longer and hence more expensive. In addition, many consumers select stainless steel for its shiny look and the demand for nonstick applied to stainless is not as high as it is for aluminum pans. Nonsticks are less commonly applied to other materials such as cast iron, glass as well.

**Application Methods**

Three major methods are used to apply nonstick coatings:

1. **Spraying**: Using air to atomize the nonstick material, the nonstick is sprayed onto the pan either automatically or by hand. Advantages include a more dense finish. Disadvantages include lower production rate than other methods and loss of expensive coating material via overspray (spray that blows past the product).

2. **Curtain coating**: Blanks (circular or square of the material used for the cookware and bakeware before it is formed into cookware or bakeware in a press) pass through a
curtain of nonstick coating while on a conveyer belt. Advantages are extremely fast production rates with almost no waste of the coating. Disadvantages: special formulations are required to coat properly and the blanks must be flat. Already formed shapes cannot be coated with this technique.

3. **Roller coating:** Blanks (circular or square of the material used for the cookware and bakeware before it is formed into cookware or bakeware in a press) pass through rollers to which the wet coating is applied. Passing through the rollers applies the nonstick, similar to rolling paint onto a wall. Advantages: Fast production rates with little coating loss. Disadvantages: Noticeable striations on the finished product. Here again, already formed shapes cannot be coated with this technique. Of these three application methods the spray is most expensive followed by curtain coating and then roller coating.

### Use and care for nonstick finishes

1. Nonstick cookware and bakeware should always be washed before its first use. Most nonstick finishes will benefit from a small amount of cooking oil rubbed into the surface for the initial use as well.
2. Heat is the enemy of nonsticks. Use of low to medium heat will preserve food nutrients as well as protecting the nonstick finish. Make sure that food, oil or water is in the cookware before heating unless the recipe calls for preheating the pan before adding food. Aluminum nonstick pans heat extremely quickly.
3. Even though many nonsticks can withstand the occasional swipe with a metal utensil, the finish will last longer if nylon or wooden utensils are used. Sharp knives will pierce any nonstick finish quite easily.
4. Foods shouldn’t be store in nonsticks (or any cookware for that matter). Nonsticks can stain if left in contact with some foods.
5. Nonstick cookware should cool before it is immersed in water.
6. Some nonstick cookware is dishwasher safe, although the high heat drying cycle of the dishwasher will degrade the nonstick finish over time. Additional dishwashers are hard on wooden handles particularly and some anodized finishes on the exterior of cookware. Hand washing is quick with nonsticks and is preferred, all though most consumers use the dishwasher anyway.
7. If burned residue collects on the nonstick surface a solution of 3 tablespoons of household bleach, 1 tablespoon of dishwashing liquid in one cup of water will usually
remove the residue, especially if allowed to soak for an hour. The surface should be reconditioned with a light wipe of cooking oil before using it again.

**Overheated nonsticks and pet birds**

Overheated nonsticks can produce fumes that are harmful and fatal to birds. While rarely does this happen when food is in a nonstick pan, it is still recommended that pet birds never be caged in a home kitchen.

Birds have very sensitive respiratory systems and have been known to succumb to ordinary cooking fumes in addition to fumes driven from overheated nonsticks.

All producers of nonstick coatings recommend that avian pets be kept well away from kitchens.

**Cookware and bakeware coatings and safety considerations**

Nonstick coatings applied to noncommercial housewares for use in homes and restaurants to prepare, dispense, or serve foods are exempt from the Food and Drug Administration’s food additive regulation under what is commonly referred to as the “housewares exemption.” There is one exception: The FDA will take immediate action to protect the public’s health if the nonstick coating is found to adulterate food with unsafe substances.

Although housewares are not regulated per se, it is incumbent on the manufacturer and the retailer to ensure that each coating is formulated with ingredients known to be safe for use in contact with food and that are appropriate for the intended conditions of use. The prudent manufacturer will have testing performed by a third party laboratory and/or obtain certification from their coatings suppliers, to ensure that the nonstick coatings comply with the same FDA test criteria as coatings used in commercial applications. Nonstick coatings produced under the housewares exemption and tested in accordance with the FDA criteria may be said to comply fully with the Food, Drug & Cosmetic Act and all applicable food additive regulations. Manufacturers should be aware that products may need to comply with other state, federal and international regulations, depending on where the products are to be marketed.

Beware of any manufacturer’s claim that the FDA has “approved” or has certified a coating. Nonstick coatings can be comprised of ingredients that are “generally recognized as safe” (known as the GRAS list) but the FDA does not test, certify or otherwise approve any coatings applied to noncommercial housewares products.

*illustrations courtesy Whitford Coatings*
Handles are an integral part of almost any type of top-of-stove cookware. They allow for the safe and convenient transfer of a pan and for stabilizing the pan during the cooking process. Handles are an important safety component of any pan used on top of the stove.

**Materials:** Handles can be made of formed metal, solid cast metal, various types of thermoplastics or blends of metal and thermoplastics. Handles can be polished, colored, painted, intentionally roughened to provide a nonslip grip. Some have silicone inserts to aid in reducing heat and increasing the comfort of the handle. Handles can also be cast as part of the pan as is the case of cast iron or cast aluminum. Metal handles can go into the oven, but some plastic handles are rated up to 400 degrees and can be used in the oven as well for many recipes. Thermal cycling of plastic handles used inside the oven does have the potential to cause deterioration of plastic handles over time however.

**Design aspects:** Handles absorb heat. Heat transfer can be reduced by insulating the handle from the wall of the pan, making the handle of nonconductive plastic, or producing a handle long enough and/or shaped in such a way to dissipate the absorbed heat. Some producers of cookware use the term “cool” or some variation of that terminology, since they have designed the handle to dissipate the heat absorbed during use of the cookware. However, no handle can be totally cool to the touch and still remain connected to the pan. It’s difficult to know how hot the pan may be under intentional use, so the CMA recommends consumers should always use a mitt, pad or other protective device when handling a hot pan.

A too-long handle also can make a pan “handle heavy” and therefore unstable with a tendency to tip. This problem is most often seen in small, 1-1/2 quart saucepan where the maker has used a universal handle more properly sized for a larger pan.
CMA Engineering Standards also call for the handle to have clearance on its underside of 1-3/16 inches at a point half way along the length of the handle. This is to give room for the user’s hand to clear any hot surfaces below the handle the pan is being used.

**Shapes and definitions:** A long single handle is usually known as a stick handle. A short handle, such as that on a Dutch oven is usually called a side handle. Most skillets and fry pans have a stick handle, but for those that weigh more than 11 pounds when filled with water, the CMA recommends a second side handle, sometimes known as a helper handle.

**Attachment of handles and testing:** Handles can be riveted through the wall of the pan, attached with a screw to a handle fixing device (often integrated with a flame guard for plastic handles, to shield the plastic from direct heat from gas burners), or in some cases be designed to grip the wall of the pan but release for storage or for use of the pan inside an oven. A handle fixing device that mates with a plastic handle is usually secured to the wall of the pan using high current spot welding. Simple one-piece handles are sometimes spot welded directly to the pan wall. See the illustrations above and below.

The CMA recommends a number of tests in its Engineering Standards to insure that the handle and its fixing method or attachment meets stringent design criteria. There are tests performed on both hot and room temperature handles and pans that help the designer determine the optimum handle for a pan. The CMA believes that good design should allow 15,000 cycles of raising and lowering pan to a level surface without loosening of the handle or its fixing system when tested with a weight 1.5 times the pan’s water capacity. Additionally for stick handles, the association recommends a torque test of 40 inch pounds be applied to the handle to check for undesirable deflection by twisting.

**Costs of Manufacturing:** The manufacturing cost of a handle includes the cost of the handle, its fixturing system and the labor and time necessary to attach the handle. Through riveting requires several operations: A punch operation to place holes in the wall of the pan, then a riveting operation that places and then heads the rivets to secure the handle to the pan. With plastic handles, the fixturing system is usually welded to the sidewall of the pan and then the handle is secured with a screw that passes through the handle and into the fixture. Some form metal stick handles can be simply spot welded to the body of the pan, depending on the pan’s material and gauge.

_Cookware Manufacturers Association_
Buyers’ Learning Tools

Unit Five:
Proper Labeling of Imported Cookware and Bakeware

By law, the U.S. Customs Service states that products imported to the U.S. must be labeled clearly with the items country of origin. Failure to properly label can result in delays in clearing customs, and a marking duty penalty of ten percent of the customs value can also be assessed in addition to expensive marking at the point of entry.

*(E)ach imported article produced abroad *(is) to be marked in a conspicuous place as legibly, indelibly, and permanently as the nature of the article permits, with the English name of the country of origin, to indicate to the ultimate purchaser in the United States the name of the country in which the article was manufactured or produced.*

**Note the key requirements of the marking:**

- **Conspicuous**—Not hidden, but visible to casual inspection.
- **Legibly**—Type large enough and with enough contrast to enable the label to be read by the average person.
- **Indelibly**—Not an ink designed to fade or a label with inadequate adhesive

**Permanently** as the nature of the article permits—Subject to reasonable interpretation.

The purpose of the labeling rule is to indicate to the ultimate user the country from which the article originated. In cookware or bakeware, clearly the end ultimate user is the consumer, and not the retailer of the product.

**Frequent Questions about Product Marking:**

**The product or the package?** Since the intent of the law is that the product’s country of origin be visible to the end purchaser, it would seem that how the product is displayed to the end user should dictate its labeling. If a pan is designed to be shown without its package, then the pan should be labeled. If it is part of a set that is contained within a color package, then the package should be labeled. If there is any doubt on the final placement or retailing of the product, then both the package and the product properly labeled would comply with both the letter and spirit of the law.

**Permanently is how permanent?** Importers argue, rightly, that the producer of goods may be producing for a number of differing countries, making it impractical to die mark the country of
origin. In most cases, adhesive labels can be used to mark the country of origin on the product in such a situation. Where items are exclusive to a U.S. importer, however, the argument can reasonably be made that marking should be cast-in-the-mold, etched, engraved or die-marked.

**Mixed products:** For products that are “mixed”, i.e. a imported glass cover and a U.S. made pan, labeling of the cover with its origin, or language on the packaging such as “cover made in Israel, pan made in U.S.A.” would comply.

**Removal of labeling:** There are numerous cases of retailers scraping off the adhesive label stating the country of origin. Doing so is a violation of law, but is practically unenforceable since customs typically inspects goods upon their entry and not their final destination. Manufacturers should specify adhesive of such quality that removal of proper and legal labels is difficult. The Federal Trade Commission has reached consent decrees with firms for removal of country of origin labels in the past however. (El Portal Luggage Stores, Inc.)

**What about “Made In U.S.A.?”** Made in U.S.A. claims come under the jurisdiction of the Federal Trade Commission. This agency has wrestled with this issue in the past. Provided the substantial transformation of the product occurred in the U.S., then Made in U.S.A. is permissible. The manufacturer does not have to be as certain that the majority of the raw materials entering the product were originally produced in the U.S. As a practical matter, substantial transformation would not include attaching a handle, packaging bulk produced product into individual boxes or mating pans with covers.

**What about “Designed in U.S.” marking?** Certainly the place of design may be included, but it does not substitute for country of origin labeling. You can reasonably assume that Customs would look askance at a larger “Designed” label than a “Made in” label.

More information is available by contacting Cookware Manufacturers Association, PO Box 531335, Mountain Brook, AL 35253 Ph 205 592-0389 or email: hrushing@cookware.org.

Cookware Manufacturers Association
Covers and lids are valuable adjuncts to many types of top-of-stove cookware. Covers and lids enable steaming, reduce cooking time, conserve nutrients in food by re-distilling steam to liquids and help control cooking time.

**Materials:** Covers and lids fall into two broad categories: glass and metal. There are certain advantages and disadvantages to each material. Some covers even combine metal, glass and plastic. There are also many different types and kinds of knobs and handles used on covers as well: wood, thermoplastics (high temperature resistant plastics), metal, and even silicone-impregnated metals. Glass covers have the advantage of enabling the user to see the food’s cooking process without having to lift the cover from the pan, but are often heavier than an equivalent metal cover. Metal covers are unlikely to break, but they require the user to remove them to check foods progress. Metal covers can be made of aluminum, stainless steel, copper, carbon steel or cast iron—all of the materials that cookware is made from.

**Design aspects:** Covers and lids should fit loosely. Overly tight fitting lids can turn an ordinary cooking pan or pot into an unintentional pressure cooker. When a cover is placed on a pan it should have a certain amount of “play” or looseness that will enable steam or rolling boils to escape the pan. There are specially designed knobs that can be turned to release steam, but covers should still not be too tightly fitted to their corresponding pans. Typically covers are designed with a “boss” or “lip” that is designed to fit loosely into the interior profile of the pan it is to be used or a raised shoulder lip or bead from the pan body itself captures the cover. See the cover profile illustration.

Metal covers and lids should be free of burrs or sharp edges.

Cracking and breaking potential are considerations for glass covers. Ideally glass covers should be made of borosilicate glass, specially formulated to withstand high temperatures and sudden changes in temperatures. The edges of the covers should be thick enough to withstand
chipping. If the covers are made of thin glass, then many producers wisely include a metal band—called a bezel or shroud—fitted around the perimeter of the cover to guard against edge chipping or cracks. The CMA, in its standards, also recommends that glass covers should comply with ASTM Standard C149 and all existing glass industry standards for thermal shock tests. Additionally, all metal bezels, shrouds or decorative rings should be designed and assembled in such a way that the glass isn’t scratched. Direct metal-to-glass contact should be avoided, if possible, by the use of gasket material to protect the glass—particularly where the part is attached under load to the glass (such as a knob).

Most manufacturers design their covers to fit more than one pan. For instance, a 10 inch diameter fry pan may have the same cover as does a 5 quart Dutch oven. While there are universal lids designed to fit a variety of sizes of pans (usually 8 to 12 inches), these simply act as covers and many do not typically mesh the cover with the inside of the pan’s sides, so stability of the lid is sacrificed. They are usually made of aluminum or stainless steel.

Look for knobs and handles large enough to be easily handled by a potholder or mitt. There are a number of issues concerning the proper attachment of knobs or handles to covers and lids. These are covered below.

Some producers make covers with deep edges that are perforated to allow for pouring off cooking water from the food inside the pan. These often are made for pans that have a pouring spout or a sidewall relieve area that conducts the water away from the food more easily. See illustration. Often these lids have knobs that are slightly oversized, allowing more clearance between the cover and the top of the lid, enabling the user to more easily hold the cover in place. Some of these covers are made of a mixture of glass and metals. For especially deep pots, such as stock pots, such strainer covers made have detents built into the cover and the pan itself to “lock” the cover in place. This is particularly useful with larger capacity pans. Water itself weighs over two pounds per quart or liter, and larger size pots are usually handled with two hands, not one!

**Knobs and handles for lids and covers:** There are two basic ways that a knob or handle can be attached to a cover or lid (unless of course the handle is molded into the lid; as in some cast iron and glass covers). For metal covers, the knob or handle can be spotwelded into place using high direct current (typically done with what is known as a strap handle, see illustration) or fixed mechanically with a rivet or a screw. For glass covers, the knobs are typically mechanically fixed with a screw or bolt.

If a knob is attached using a screw, the CMA recommends that the screw threads engage the knob a minimum of three full turns. Additionally, the CMA also recommends telling the consumer how to tighten the screw(s) should the knob or handle become loose.
The CMA also recommends particularly that knobs attached to glass covers have gasket material installed between the knob and the surface of the glass to guard against scratching of the glass or placing the glass under undue tension, which might allow sudden shattering of the part.

Knobs designed to release steam should be designed and installed in such a manner than turning the knob “closed” can be accomplished without undue force being used.

Cookware Manufacturers Association
PFOA, or APFO (also known as C8), is a surfactant chemical used in the production of PTFE, nonstick finishes. There are several manufacturers of PTFE finishes for cookware and some cookware producing firms produce their own nonsticks within their own factories.

PFOA and its associated materials is currently being studied by the EPA to determine if the chemical is a potential carcinogen for those exposed to high levels of the product. These surfactants have been used for more than fifty years without known harm to individuals.

It is important to understand that PFOA is not part of the finished product of nonstick cookware or bakeware. While used during the manufacture of the product and while there is a small amount in the finished nonstick liquid product when it is shipped to the applicator, all of the PFOA is driven off in the curing process following the application of the PTFE spray to the pan’s surface. Tests have shown finished pan does not contain any measurable PFOA after proper curing.

The consumer is never exposed to PFOA while using their nonstick pan. Retailers should feel confident in reassuring their customers that proper use of PTFE coated pans is perfectly safe.

Cookware Manufacturers Association
Buyers’ Learning Tools

Unit Eight:
Green Labeling and Environmental Marketing Claims

The U.S. Federal Trade Commission’s Guides for the Use of Environmental Marketing Claims (Green Guides) are the centerpiece of the agency’s environmental marketing efforts. The Green Guides help marketers avoid making false or misleading green claims by explaining how consumers understand commonly used terms, such as “biodegradable” and “recyclable,” and by describing the basic elements needed to substantiate those claims. The complete text of the guide can be found here.

Here are some highlights and particular factors to consider when labeling cookware and bakeware with environmental claims.

**Claims should be substantiated.** As with all advertising claims, the producer should substantiate thoroughly any claims made for the product. This substantiation should be accomplished before the product is placed into the marketplace, not after.

**An environmental claim should not overstate the environmental attribute of benefit expressly or by implication.** Marketers should avoid the implication of significant environmental benefit if in fact the benefit is negligible. For example, a packaged labeled 50% more recycled content than before when the increased recycled content of the product increased from 2 percent to 3 percent would create a false impression.

**Comparative claims should be presented in a manner that makes the basis for the comparison clear to avoid consumer deception.** For example, a product claiming that "less energy used to produce this product" should in fact be substantiated and qualified. Less energy than what? The previous product? A competitive product?

**It is deceptive to misrepresent, directly or by implication that a product, package or service offers a general environmental benefit. Every claim must be substantiated.** For example, a brand such as "Eco-Safe" would be deceptive if it leads consumers to believe that the product has environmental benefits when, in fact, there is no substantiation as to any benefits the product has for the environment. Examples of other potentially problematic statements would include: "environmentally safe," "environmentally friendly," "non-toxic," or "earth smart".

Cookware Manufacturers Association