

THERMOSETS - THE FORGOTTEN ENGINEERING PLASTIC

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The first commercially available synthetic material, Celluloid (cellulose nitrate), was invented in 1866 by John Wesley Hyatt as a replacement for ivory for use in billiard balls. Since that time, scientists have continued to develop new plastics to provide consistent material alternatives for durable goods.

The first commercial thermoset plastic was developed by Dr. Leo Baekeland in 1909. It was a phenolic material trade named Bakelite. This thermoset material offered the new benefit of being firmly set -- not changing its shape, even under heat and pressure. Bakelite was used extensively as an insulating material for handles on cookware and irons, and later found its way into applications such as telephone earpieces, electrical housings and connecting blocks. It was also a key ingredient in many of the weapons used in World War II.

During the 1940's thru 1960's there was an acceleration of plastic material development with additional thermosets including unsaturated polyesters, epoxies, urethanes, and melamines. Commodity thermoplastics (e.g. polyethylene polypropylene, polystyrene) and some engineering thermoplastics (e.g. nylon, ABS, and acetal) were also developed. These materials lived harmoniously, with each taking its share of the plastic market based on its relative strengths. The commodity resins captured the low strength, low temperature, and disposable market applications. The engineering thermoplastics were used in high strength, moderate temperature applications. And the thermosets dominated the high temperature applications.

In the late 1960's thru early 1980's, however, polymer development continued with the introduction of high temperature thermoplastics. New generic families of polymers such as the sulfones, phenylene sulfides, ketones, and liquid crystalline materials came on the market, providing temperature ratings in the 170-240 degree C range. Not only were these new families of plastics able to compete with thermosets on temperature capability, they were typically viewed as more molding friendly and recyclable due to the re-melt characteristic of thermoplastic. These high temperature thermoplastics were heavily marketed by their developers, touting these advantages. Product engineers began to specify these materials, taking share away from thermoset materials.

Fast forward to today, a time of increasing performance demands and extreme price pressures. High performance thermoplastics are being specified in many product designs. One of the big disadvantages of these high temperature thermoplastics is the price for the performance. Most of these high heat materials are priced in excess of \$5.00 per pound and can be as much as \$35-40 per pound. Thermoset resins, on the other hand, are under \$2.00 per pound and some are as inexpensive as \$.60 per pound. Thermosets, applied properly in many high strength, high heat products, can provide the OEM with a very cost effective solution. Not only do they deliver a high performance to price ratio, they offer physical property advantages over most thermoplastics in the areas of :

- creep resistance
- thermal stability
- hardness
- dimensional stability
- compressive strength

Engineers need to revisit these forgotten engineering plastics. If your molder cannot offer you the option of thermoset material choices, you might be giving money away with the product you sell.

Thermotech processes most types of both thermoplastic and thermoset resins. We can assess your application, without bias, for the most cost effective material option. If you have a high temperature application that you would like us to evaluate, please contact Tom McNamara at **952.933.9438** or thomas.mcnamara@thermotech.com