Plastics vs. Ceramics: The Battle of the Durables

"I'm convinced that our wonderful industry has an environmental value proposition that trumps anything the metals folks can put on the table." — Kevin Short, IAPD President

by Mark Shriver and Brian Reuss

Throughout 2015 the Environmental Committee focused on this challenge issued by IAPD President Kevin Short: To improve the awareness of our environmental value proposition across IAPD. The committee used this magazine column to compare the environmental benefits of performance plastics to traditional materials such as metal, wood and glass. We publicized the beneficial environmental attributes that make our products not only the best choice, but quite often the sustainable choice in most situations. In this article, we compare plastics to ceramics as we further explore the growing benefits and the sustainable attributes of our industry's products and offerings.

One of mankind's earliest inventions, ceramics, dates back tens of thousands of years to a time when early humans began making simple vessels for carrying liquids and cooking foods. We know this because ceramics are often an exciting find in ancient excavation sites as archeologists use them to date their discovery. This wonderful long-lived property is one of the few shared values between plastics and ceramics.

Ceramics are found in a range of applications from bricks and cement to fiber optics and space shuttle tiles. Similar to plastics, they are all around us. Most people think of ceramics in the traditional sense as being made up of a mixture of earthen elements such as clay, silica and water. These materials are then shaped, glazed and fired in a kiln at high temperatures. While this is still a process used today, advanced ceramics are made quite differently now. Additives and process advancements have improved the product and given them some advantages over other traditional materials. They are harder and stiffer than steel, are resistant to heat, are great insulators and their raw materials are plentiful and inexpensive.

Ceramics are truly a material that has stood the test of time and they aren't going anywhere soon. However, over the past 150 years and primarily since the 1940s, the new kid on the block — performance plastics — has replaced ceramics in thousands of applications. From simple household items to high tech solutions, plastics continue to strip away the limitation of ceramics and other traditional materials allowing scientists, architects, engineers and designers to shoot for the stars when it comes to improvement, innovation and even sustainability.

Today, the material of choice is performance plastics more often than ever and for many reasons. Starting with its sustainable attributes, performance plastics are typically less expensive, easier to shape, lighter and use less energy to produce. They have the long-life quality that ceramics boasts, too, but are much more recyclable when necessary. Plastics' versatility allows us to do more with architecture, transportation, communications, food, medical devices and it is in, and has improved, virtually all industries. Many of the innovations of the past 50-100 years could not have been accomplished if it not for plastics.

The area where plastics have been replacing materials like ceramics the most is closer to home, the kitchen. Everything from utensils, bowls and oven bakeware are now commonly made of plastics. Other areas of the home where performance plastics are in use are in switches, sockets, fixtures and electrical devices.

Through engineering and technological advancement, plastics are finding more and more uses. Their light weight and great toughness have proven valuable in many applications including the aerospace industry where 50 percent of a new airliner may be manufactured from performance plastics. Solar panels use plastics to help achieve higher efficiencies than ever thought possible, even just a few years ago. A major inroad into the ceramics area has been the use of plastics in semiconductor packaging. Plastics have allowed these items to be made cheaper, smaller and more efficiently.

There is also an increasing use of plastics by the traditional material manufacturers. Examples include hybrid efforts such as safety glass, coated woods, paper coffee cups and lined piping. Go figure! The very same industries that claim superiority to plastics are using performance plastics to eliminate weaknesses in their own. The ceramics industry is no different. They often use plastic as a binder or glue to alleviate the difficulties in maintaining dimensional tolerances. The plastic is then burnt off, allowing the shape to be made while controlling the shrinkage that occurs during the sintering process. This technique has allowed the ceramics industry to create many of their high-end, precision electronic products.

When selecting materials for any given application, it is important to consider the true environmental impact of the material. The true environmental costs for plastics are lower than ceramics given the extremely high sintering temperatures, the fact that plastics are used to form ceramics (then burned out in the sintering process) and the ceramic materials typically have longer decomposition lifetimes than plastics. Add to this the weight differential and recyclability advantages and the environmental value proposition of plastics over ceramics increases.

All materials will play an important role in shaping the world for future generations. As discussed above, none will be more important than the role performance plastics will play in building a more sustainable world we can be proud to leave for our children.

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