SCHAEFER ENGINEERING

2004 Winter Newsletter

FEATURED

FORENSIC FEATURES

Mysterious Plastics

Many times Schaefer engineers and scientists have been asked about a 'Mystery' plastic. Have you ever stopped by your local fast-food restaurant for a quick bite only to find an unidentifiable object in your food? Has there been a time when you opened your favorite bag of chips, grabbed a handful, and saw something that was definitely not a potato chip?

Identification of 'Mystery" plastic is often an important aspect of our investigations because they melt, fail, degrade, and change with time. Sometimes, the plastic is identifiable from manufacturer markings. Many times, identification is clouded due to fire debris, such as screws and insulation, imbedded in the plastic's charred remains or the melting of the plastic. These situations raise many questions. What kind of plastic is it? Where did the plastic come from? How was the plastic used? What is within the plastic? Will the plastic burn/melt/dissolve?

Typically, identification cannot be determined using visual observation or touch. Plastics have many appearances from light foams, such as polyurethanes used for insulation, to dense polyester plastic knife handles. Plastics can be made heavier, lighter, or even magnetic by adding a variety of non-plastic additives. Commercially, there are over 20,000 different types of polymers and an equal number of additives that are used in making plastic goods.

Some plastics contain as much as 80% of 'other stuff' called fillers. Fillers can make translucent plastics opaque, black, pink or yellow. Using analytical techniques, Schaefer engineers can tell you what fillers there are and how much are present. Identification of plastic needs to be conducted by personnel trained in plastic, like the engineers at Schaefer, using state of the art equipment. Fundamental tests are required before correct plastic identification can be made.

Specific tests can reveal chemical signatures that are as characteristic to the plastic as fingerprints are to humans. These tests can be as simple as melting the plastic or as complex as shining the plastic with a laser to determine the chemical bonds present.

Proper testing and analysis can quickly lead to a correct plastic identification. The experts at Schaefer can determine the flammability of the plastic, if the plastic will self-extinguish, whether or not it contains a fire retardant, and if the fire retardant is effective. We can also determine if the plastic will resist chemical attack, such as attack from chlorine compounds in the city water. Kevin Gaw, Ph.D., is a plastics engineer at Schaefer Engineering available to assist you in all matters concerning plastics.

So, if you have a mystery plastic, send us a sample and we will help reveal the mystery of your plastic. You can also contact Schaefer Engineering to have a sample kit mailed to you.

Kevin Gaw, Ph.D., M.S. Mat. Sci., B.S. Mat. Sci, is a Senior Material Scientist and Plastics Engineer with Schaefer Engineering Corporation in Seattle, WA.

Look for us at these events

OCAA Spring Symposium
(Oregon Casualty Adjusters Association)
April 21 ❖ Wilsonville, OR

NFPA 2005 Convention
(National Federation of Paralegal Association)
April 28 - May 1 ❖ Las Vegas, NV

CSCA Annual Seminar
(Colorado Springs Claims Association)
May 6 ❖ Colorado Springs, CO

Schaefer Engineering Golf Tournament
May 27 ❖ Golden, CO

Materials Testing & Analysis

What do failed automotive parts, plastic pipes, buildings (large and small), power plants, bolts, fire retardant foam, home appliances and processing plants have in common? They are all made of materials that have a history. Their history tells a story about what might have caused a failure, such as a structural collapse, fire, flood or crash. The experts at Schaefer Engineering can tell you how, why and where these materials failed. More often than not, the answer to these questions are hidden inside the materials that make up the product or system under investigation.

As shown in Table 1, materials that can be analyzed include; metals, ceramics, composites, and plastics; such as copper, concrete, fiber reinforced plastic and polyvinylchloride (PVC). Biological material including wood, bone and mold can also be analyzed and characterized.

Keen observation skills and knowing what questions to ask before arriving at a scene are key to a successful investigation. Experts use various test methods and instruments to analyze materials, which can help point to a cause of failure.

When many materials are manufactured, a specific recipe is followed from start to finish to produce a material that behaves properly under its expected conditions for use. The mechanical, thermal, electrical, and chemical properties of the material are controlled and refined.

This recipe can answer the following questions: Can the hammer withstand being thrown on the ground from a third story building without breaking? Can I heat my product to 900°F without melting or cracking it? How cold can the plastic pipe get and still bend? Will the product resist chemical attack?

The history of a material is found in the material itself. The forensic engineers and scientists at Schaefer Engineering know which analytical technique to use to extract that information. Sometimes it involves looking at the physical characteristics under an optical microscope, then cutting, mounting and polishing the sample to examine it under metallurgical and scanning electron microscopes. Looking at the physical characteristics can give us qualitative information about its chemical composition as well.

Metals

copper and its alloys, cast irons, heat resistant alloys, carbon steels, lead (Pb), Nitol, stainless steel, low-alloy steels, aluminum, galvanized steels, cast irons, refractory metals and alloys, pure metals and alloys. Special-purpose: electrical resistance alloys, electrical contact materials, low-expansion alloys, magnets, rare-earth metals.

Ceramics

Portland and refractory cements, concrete, tiles, bricks, sedimentary (sandstone), metamorphic (marble) and igneous (basalt) rock materials, flyash, dirt, mortars, glass, computer components, concrete masonry units, stucco, plaster, terrazzo concrete.

Plastics

polypropylene (piping, fabrics, electronic enclosures)
polyethylene (containers, piping, consumer goods)
polyvinyl chloride/PVC (piping, electrical insulation)
acrylonitrile-butadiene-styrene ABS (waste piping, electronics)
polycarbonate/PC (plexiglass, CD cases)
synthetic rubber (tires, gaskets, hoses, capacitor bungs)
acetal (plumbing fixtures)
nylon and acrylics (fabrics)
super absorbent fibers (diapers)
cyanoacrylates (adhesives)
acrylics, PMMA, MMA, latex, polyglycols, PVA (paints)

Composites

oriented strand board (architectural OSB)
sheet molding compound (automobile fenders)
Novolac phenolic compounds (electronic potting compounds)
polyaramid fibers (Kevlar)
epoxy composites (printed circuit boards)
carbon fibers (Boeing 787, tennis rackets)
PMMA (composite matrix, boats, chairs, panel boards)
Polyimide Molding Resin/PMR (high performance composite matrix, rockets, F-22)

Biological

paper, wood products, timber, mold, bones

Table 1

We are often asked to quantify the chemical composition to determine if the recipe was properly followed. Was too much chromium added? Maybe the manufacturers added too much filler to their paint causing it to crack. Did the stonemason choose the correct mixture for the mortar? Analytical techniques like Fourier Transform Infrared (FTIR) analysis, x-ray microscopy (EDS) and x-ray diffraction (XRD) tell us what elements, or what compounds, are found in our material.

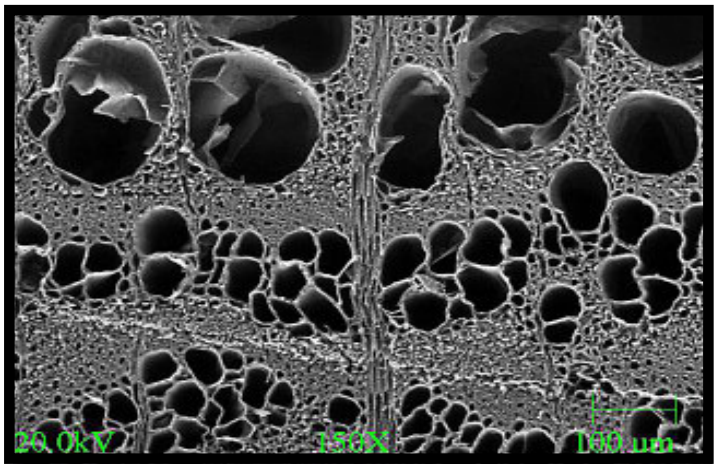
We can test mechanical properties using our micro-indenter, tensile and hardness testers, micro-strain gauges, pressure testing, and our thermal chamber. We also specialize in testing materials to see if they comply with ASTM and UL standards.

Here are some examples of questions that involve material failures. Whether the material ultimately failed due to manufacturing, installation, contamination or improper use is all part of the investigation.

- Why did it burn?
- Why did the tire explode?
- Is our product going to give us problems?
- Will the bridge collapse?
- Why are the lights in my gallery burning out so often?
- Why is the manufacturing process failing at this stage?
- How can we tell if our surface treatment made any difference?
- Why is the cement cracking?
- Why did the basement flood (and ruin our coveted record collection)?
- Is our manufacturer giving us a sub-standard product?
- My neighbor dug a hole for a swimming pool. Did that construction damage my property?
- Why did the substation melt into the ground?

Materials often show their failure history in patterns. As forensic engineers and scientists, we are experts in the illumination and interpretation of those patterns. In the end, the answers to who, why, how and where can be found in the material.

Tracy Challman, B.S. Mat. Sci, is a Materials Scientist and Ceramic Engineer with Schaefer Engineering Corporation in Seattle, WA.



Wood

Announcement:
Building Envelope Division

Schaefer Engineering Corporation would like to announce the expansion of our building envelope services. This division will provide greater support to our clients in need of engineering consulting in the areas of commercial and residential building envelope construction defects, which have resulted in water intrusion and subsequent structural damage.

Schaefer Engineering has invested in specialized equipment and training for this division. The division consists of civil, structural and material engineers, scientists, and architectural and estimation experts. We have Certified 3rd Party EIFS Inspectors on staff, which qualifies us to inspect EIFS cladding on residential and commercial structures for installation and material defects that have resulted in water intrusion and damage to the underlying structure.

For more information please contact Greg Marbett at (877)-736-1106