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# ASTM Chemical Standards Supporting Science, Innovation, and Quality Manufacturing

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# ASTM Chemical Standards: Supporting Science, Innovation, and Quality Manufacturing

The global chemical industry and ASTM International have partnered for more than 100 years. Today, ASTM standards contribute to research, production, and environmental safety and to thousands of finished products manufactured from rubber, plastics, and raw materials.

## Chemicals Build Products We Need (D16)

Many consumer items – from electrical and electronic devices and sports equipment to food packaging and medical equipment – derive from petrochemicals. Petrochemicals, which are produced as side streams from crude oil and natural gas, include benzene, toluene, styrene, and xylenes. Committee D16 on Aromatic Hydrocarbons and Related Chemicals develops standards for these polymer ingredients. D16, formed in 1944, has developed more than 140 standards covering these raw materials and solvents.

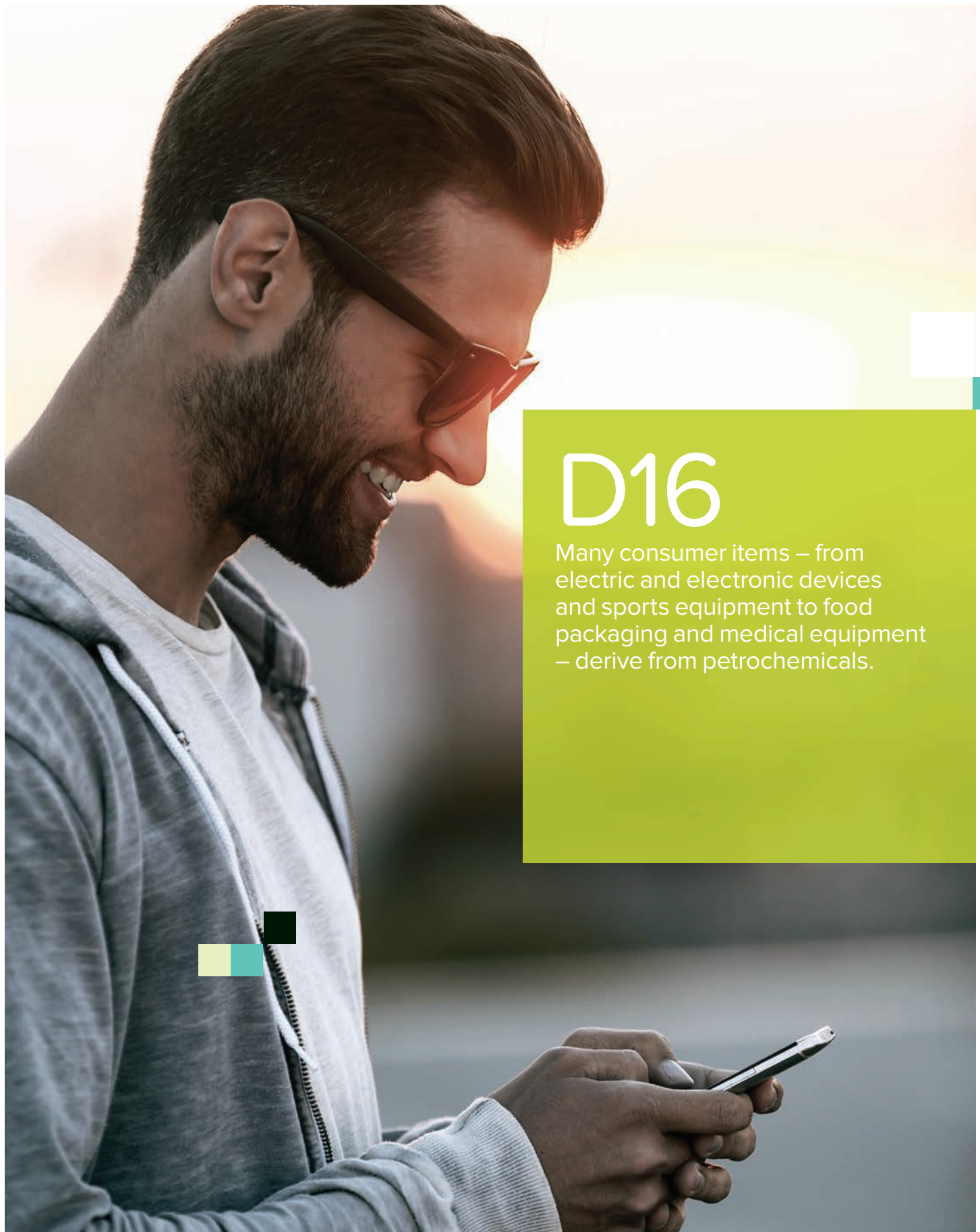
- To control petrochemical quality, refiners need to determine material purity and trace impurities. An important test method uses gas chromatography and effective carbon number to quantify the purity and impurities in monocyclic aromatic hydrocarbons (D7504). The test can be used for process control and inspection as well as setting specifications. The test reduces laboratory time and variability between laboratories.
- Committee D16 has recently focused on test methods for purified terephthalic acid, or PTA, a raw material for polymers and plastics used in polyester fiber, resin, and film. The standards describe how to determine 4-carboxybenzaldehyde and p-toluic acid in PTA

using four different processes: high performance capillary electrophoresis with reverse voltage (D7881); high performance capillary electrophoresis with normal voltage mode (D7882); weak anion exchange high performance liquid chromatography (D7883); and reverse phase high performance liquid chromatography (D7884).

- Another D16 standard guides the performance testing of process analyzers used for on-line analyzers, which is critical for ensuring their function within predictable levels of precision and accuracy (D6621). These analyzers are used to measure chemical or physical characteristics of liquid aromatic hydrocarbon materials for production or certification.

## Detecting Impurities in Fuels (D02)

Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants, one of ASTM International's largest committees, has more than 2,400 members worldwide. The committee is responsible for over 800 standards critical to producing fuel. Among these standards are tests for impurities in producing petrochemicals. A test to determine trace levels of silicon in gasoline (D7757), which damages engines, was developed so that the situation could be monitored and addressed. The committee has also contributed methods to determine mercury in crude oils (D7622 and D7623) to assist refineries in controlling the amount of mercury in the raw material. Additional standards address the measurement of very low levels of sulfur in fuels, which also needs to be controlled. And a large number of D02 gas chromatographic methods are used to determine organic impurities and fuel composition.



# D16

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# Relevant

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### Proven Relevance in Rubber Standards (D11)

One of ASTM International's most diverse technical committees in the chemical sector is Committee D11 on Rubber. Since 1912, D11 has played an important role in developing standards used to evaluate rubber and rubber chemicals. With more than 320 members from over 25 countries, D11 delivers high quality standards that are truly relevant to the needs of people around the world. D11's portfolio of more than 220 standards: supports communication among producers, users, testing laboratories, and customers; helps with material procurement; and helps define product requirements. Rubber product manufacturers also rely on D11 protocols to evaluate rubber properties and conduct research and development.

Committee D11's standards work falls across more than a dozen technical subcommittees and covers three core areas: testing and analysis, raw materials, and rubber products.

- One standard helps evaluate how well vulcanized thermoset rubbers and thermoplastic elastomers will withstand tensile (tension) forces (D412).
- Another test method (D471) covers how rubber and rubber-like compositions withstand the effect of liquids. D471 is valuable to industries such as automotive, where rubber parts (seals, gaskets, hoses) may be exposed to oils, greases, fuels, and other fluids during service, causing deterioration and affecting performance.
- In addition, a method for thermoplastic elastomers (D7605) helps with process quality control.
- Residual accelerator chemicals in medical gloves, which can cause allergic contact dermatitis in healthcare workers, is addressed in another standard (D7558). The standard details a colorimetric/spectrophotometric procedure to quantify extractable chemical accelerators (dialkyldithiocarbamate, thiuram, and mercaptobenzothiazole) in natural rubber latex and nitrile gloves. Test methods in the standard help glove makers monitor residual chemicals in their end products and to potentially make manufacturing changes to reduce allergen levels.
- The food service industry benefits from the specification for food service gloves (D7329), a comprehensive and broad-based standard. The standard provides manufacturers and the food industry with specific performance specifications, dimension and tolerance specifications, physical requirements, and quality specifications for thin film, unlined polymer gloves. A related standard helps detect holes in polyethylene food service gloves (D7246).

### Fostering Reliability in Consumer Rubber Products (D11.40)

D11's subcommittee on consumer rubber products (D11.40) emphasizes material specifications and test methods for rubber gloves used in the healthcare and food services industries and for contraceptive devices. In the United States, the Food and Drug Administration (FDA) regulates these product groups and references D11 standards as acceptable methods and specifications to show compliance.

- Glove manufacturers benefit from the specification (D3577) that covers the requirements for packaged sterile rubber surgical gloves made of natural and synthetic rubber latex.
- Another standard specifies nitrile examination gloves for medical use (D6319) and offers tests to evaluate their performance and safety.



### The World's Leading Carbon Black Standards

Carbon black, the primary reinforcing agent for rubber compounds, plays an essential role in numerous products, particularly car tires. By conducting heat away from the tire's tread and belt area, carbon black reduces thermal damage, which improves tire performance and increases service life. Carbon black is also used in other consumer and industrial products, adding strength and durability to printing inks, toners, and paints as well as plastics and building products.

Committee D24 is the preeminent source for carbon black standards focused on composition, properties, classification, nomenclature, analysis, and quality assurance. The committee's dedication to delivering globally recognized standards is reflected in its international membership of technical experts from industry leaders and globally recognized brands.

- One widely used standard in this area classifies carbon blacks used in rubber products (D1765). The system organizes rubber-grade carbon blacks based on such factors as the cure rate of a typical rubber compound containing the black and the average surface area of the black. D1765 currently lists more than 40 grades of carbon black, making it an authoritative reference for producers and users engaged in global trade.
- D24 also offers test methods to evaluate carbon black properties such as structure and surface area or particle size and how these properties correlate best with rubber reinforcement. These methods are particularly useful in tire engineering, where selecting the right black for each component of the tire can impact performance. Standards such as the tests for carbon black oil absorption number and oil absorption number of compressed samples (D2414 and D3493) estimate carbon black structure. Similarly, surface area properties are measured by standards such as the carbon black iodine adsorption number method (D1510).
- Subcommittee D24.66 on Environment, Health, and Safety is developing standards that address health- and safety-related aspects of carbon black testing and manufacturing. Among the several standards D24.66 has developed are tests for carbon and sulfur content in carbon black feedstock oils (D7662 and D7679). The group also provides guidance to other D24 subcommittees.





# Valuable

Test methods are useful in tire engineering applications, where selecting the right black for each component of the tire can impact performance.



### Spurring Innovation and Growth in the Global Plastics Industry

Plastics play an indispensable role in the health, safety, and overall quality of our daily lives. Whether used in product packaging, building and construction materials, sports equipment, furniture, electronic components, coatings, or other applications, plastics impact our world in many ways. The plastics sector is also one of the largest global manufacturing sectors. According to the Society of the Plastics Industry, plastics account for more than \$380 billion dollars in annual shipments in the United States alone.

Plastics are the focus of one of ASTM's largest, most active technical groups, Committee D20. More than 1,000 members participate on one or more of D20's numerous subcommittees and have responsibility for more than 470 standards. D20 members represent about 50 countries and the entire plastics industry supply chain, including raw material producers, finished product manufacturers, and users.

- D20 standards help specify, test, and assess the physical, mechanical, and chemical properties of a wide variety of materials and products made of plastic and polymeric derivatives. Notable standards include a method for tensile properties of plastics (D638), useful for design as well as research and development. For evaluating thermal properties, the test method for Vicat softening temperature of plastics (D1525) offers data to compare the heat-softening qualities of thermoplastic materials.
- Materials subcommittees cover numerous types of plastics used by diverse industries, including cellular, olefin, and reinforced plastic; thermoplastic and thermosetting material; and film and sheeting. Among the many widely referenced standards are a specification for polyethylene plastics pipe and fittings materials (D3350) and a test method for environmental stress cracking of ethylene plastics (D1693).
- Plastic building products are another area of standards work. Subcommittee D20.20 on Plastic Lumber offers standards such as a test method for compressive properties of plastic lumber and shapes (D6108), a quality control reference for manufacturers and suppliers. Other standards, for polyolefin-based plastic lumber decking boards (D6662), polymeric piles (D7258), and polyethylene-based structural-grade plastic lumber for outdoor applications (D7568), cover performance requirements. And a specification for color and appearance retention of

solid and variegated color plastic siding products (D7856) can be used by siding manufacturers, color systems suppliers, and outdoor weathering laboratories.

- The Consumer Product Safety Improvement Act of 2008 prohibits certain products from containing six specific phthalates. A standard from D20 provides a thermal desorption method to identify and quantify these materials (D7823).

### Responding to the Demand for Biodegradable Plastics

Another notable D20 group responds to the growing call for biobased plastics, which are derived from renewable sources instead of fossil fuels. As issues of sustainability and environmental safety continue to emerge throughout the world, companies are investing more in biobased and biodegradable plastics. Subcommittee D20.96 on Environmentally Degradable Plastics and Biobased Products is responding with standards that address such topics as the heat aging of plastics, anaerobic biodegradation of plastic materials, compostability of environmentally degradable plastics, and more.

- One of the committee's most widely used standards is the specification for labeling plastics designed to be aerobically composted in municipal or industrial facilities (D6400). The standard covers plastics and products made from plastics that are designed to be composted in municipal and industrial facilities.
- Also popular is a test method (D5338) that helps determine the rate and degree of aerobic biodegradability of plastic products in a controlled composting process.
- The subcommittee on recycled plastics (D20.95) offers a range of guidelines and practices for handling, recycling, and disposing of plastics, including the standard practice for coding plastic manufactured articles for resin identification (D7611/D7611M). Resin Identification Codes identify the plastic resin used in a manufactured article, which helps ensure the proper use of the coding system. A recent revision to the standard modernizes the RIC system for more effective use and to address recent polymer application and material innovation.





Plastics standards boost the plastics industry while also responding to environmental concerns.

### Supporting Quality and Performance in Paints and Coatings (D01)

Another longstanding group with an enduring impact in the chemical field is the committee on paint and related coatings, materials, and applications (D01). Formed in 1902, D01 has grown to include over 600 members in about 40 countries. These experts are responsible for more than 650 standards focused on the classification, sampling, preparation, components, application, analysis, quality assurance, and end-use performance requirements of paints and coatings.

- Many D01 standards help paint manufacturers make products that meet customers' expectations for quality and durability. For example, manufacturers often rely on a test method (D1475) that helps measure density of paints, inks, varnishes, lacquers, and components. Scratch and mar resistance is also a primary quality control requirement of paints and coatings, and D01 provides a tape test for measuring adhesion by tape test (D3359). Another method (D5178) helps differentiate the degree of marring of organic coatings on substrates.
- Committee D01 has also responded to concerns about indoor air contamination caused by volatile organic compound (VOC) emissions from paints and coatings. In the United States, regulations limiting VOC emissions rely on D01 standards for measuring total volatile content, exempt solvent content, and paint or coating density. U.S. Environmental Protection Agency regulations reference many D01 standards as acceptable test methods for regulatory compliance. Notable among these is a standard practice for determining VOC content of paints and related coatings (D3960) and a test to determine individual VOCs in air-dry coatings by gas chromatography (D6886).

### Supporting Compliance with Environmental Regulation (F40)

ASTM International Committee F40 on Declarable Substances in Materials was formed in 2005 to guide global industry in the management and compliance requirements of hazardous materials. Regulations pose challenges to manufacturing and supply chain infrastructure worldwide. Legislation has restricted the content of certain hazardous substances in materials used in several industries, including packaging, vehicles, and electrical and electronic devices.

Committee F40 develops standards to evaluate materials and products relative to RoHS (Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals), and similar regulations.

- An important standard in this area is a method for identifying and quantifying chromium, bromine, cadmium, mercury, and lead in polymers using energy dispersive X-ray spectrometry (F2617). F2617 describes how to screen and quantify the amount of elements in polymers used to make consumer products.
- F40 developed a method to determine lead in paint layers and other materials by energy dispersive X-ray fluorescence spectrometry using multiple monochromatic excitation beams (F2853). This helps identify and quantify lead in toys and other consumer products.
- Another standard from F40 helps assess materials and products for declarable substances (F2577). The standard includes a general process and case studies relevant to European Union directives to illustrate the decision process.
- The subcommittee on rare earth materials (F40.04) works on standards to help drive greater efficiency and sustainability in the production, use, and recycling of rare earth materials. These chemical elements play a role in making smartphones, LCD televisions, and energy efficient light bulbs, smaller and lighter; they are also used in technologies including wind turbines and solar panels.

Whether supporting raw material suppliers throughout the industry supply chain or helping manufacturers deliver the quality products we rely on every day, ASTM standards will continue to play a vital role in the chemical producing industry around the world.

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**The ASTM technical committees highlighted in this piece include:**

- D01 on Paint and Related Coatings, Materials, and Applications
- D02 on Petroleum Products, Liquid Fuels, and Lubricants
- D11 on Rubber
- D16 on Aromatic Hydrocarbons and Related Chemicals
- D20 on Plastics
- D24 on Carbon Black
- F40 on Declarable Substances in Materials

In addition to standards in the chemical field relevant to raw materials and product manufacturing, ASTM committees such as E27 on Hazard Potential of Chemicals and others develop standards for the physical analysis and testing of chemicals, which are not covered in this overview.

**ASTM INTERNATIONAL**  
**Helping our world work better**

Over 12,000 ASTM standards operate globally. Defined and set by us, they improve the lives of millions every day.

Combined with our innovative business services, they enhance performance and help everyone have confidence in the things they buy and use – from the toy in a child’s hand to the aircraft overhead.

Working across borders, disciplines and industries we harness the expertise of over 30,000 members to create consensus and improve performance in manufacturing and materials, products and processes, systems and services.

Understanding commercial needs and consumer priorities, we touch every part of everyday life: helping our world work better.

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