Lab Grade Flooring Committee Web Meeting

Wednesday, April 3, 2024 - 11:00—12:00 (New York Time)

Chair - Tom Ricciardelli

MEETING AGENDA

- Approve Minutes from Last Meeting
- Continue Work on Draft Lab Flooring Standard
    - Review Flooring Requirements by Lab Type Matrix
- Review Overall Document and Remaining Sections to Complete

Minutes of the Lab Grade Flooring Committee Web Meeting

November 2, 2023

Chairman: Thomas Ricciardelli SelecTech, Inc.

The meeting was called to order by Chairman Tom Ricciardelli at 1:00 PM (ET).

Tom then gave a review of the last meeting regarding the direction of the proposed standard for Laboratory Grade Flooring and in particular, the Purpose and Scope. At the last meeting, it was decided to create flooring requirements that were particular to the lab type. Lab types that will be included in the draft are:

- BioSafety 1 and 2
- BioSafety 3 and 4
- Chemistry/General
- Chemistry/Organic
- Physics
- Clean Room
- Vivarian ABSL 1 and 2
- Engineering/General
- Workshops
- Electronics
- Trace Metals
- Computational
- K-12

The group then reviewed the list of characteristics that would be recommended for each type of lab. In general, the group decided to not include general flooring requirements such as flammability, smoke generation, and load resistance. These characteristics are more a function of the building requirements and not of the lab activities. It was decided to include the following characteristics and their specifications regarding laboratory grade flooring.

- Chemical Resistance
- Abrasion and Scratch Resistance
- Ease of Cleaning
- Heat/Cold Resistance and Thermal Shock
- Flammability/Flame Spread
- Impact Resistance
- Load Bearing Resistance
- Dynamic Rolling Load Resistance
- Spill Containment
- ESD Protection

- Slip Resistance

Tom also had a review done by the work surfaces group regarding the characteristics that would be required by lab type for work surfaces. This was used as a basis to start the process of selecting required characteristics for lab grade flooring by lab type. Tom agreed to take the results of today's discussions and create a draft set of standards for discussion at the next meeting.

Tom also quickly reviewed the contents of the remainder of the document, which contains descriptions of the various flooring types and their typical uses, maintenance, and installation. Most of these sections are complete as a draft, but some need further input. Tom agreed to complete these sections so that the next draft would be somewhat complete, understanding that the draft would require detailed review by the group.

The meeting was adjourned at 2:00 pm (ET).

Purpose and Scope

These Recommended Practices provide a comprehensive single source of knowledge pertaining to laboratory flooring. These Recommended Practices cover the specifications, installation, testing, maintenance and safe use of laboratory flooring. SEFA has made these Recommended Practices available as a guide for regulatory agencies, architects, engineers, consultants, specification writers, contractors, manufacturers and dealers of laboratory flooring, installers, facilities managers and users who specify, recommend for purchase, install and/or use laboratory flooring.

These Recommended Practices focus specifically on the required characteristics of flooring, used in the most common laboratory applications. These criteria include:

- Chemical Resistance
- Abrasion and Scratch Resistance
- Ease of Cleaning
- Impact Resistance
- Slip Resistance
- Dynamic Rolling Load Resistance
- Bacterial Resistance
- Spill Containment/Seamless Construction
- ESD Protection

These Recommended Practices provide guidance on which of attributes are important to consider by the type of lab under consideration.

There are several, more specific attributes prescribed for critical applications in the industry, including, for example, biosafety laboratory requirements, cleanroom requirements, electronics handling requirements, hazardous drug laboratory requirements. This Recommended Practice does not cover those additional requirements. Standards and recommendations exist for those types of applications and users should refer to those for guidance.

While generally not required for performance considerations, environmental considerations can also play an important role in selecting flooring for a particular laboratory.

The scope of SEFA XX is limited to flooring types that are most commonly used in laboratories. Although SEFA attempts to be inclusive of all generic products normally used in laboratories and welcomes information about such products for inclusion in SEFA XX, SEFA does not represent that every potential product is included. The products included in this version of SEFA XX are the following:

- Sheet Vinyl
- Rubber
- Linoleum
- Ceramic
- Porcelain
- Quarry
- Polished Concrete
- Floor Coatings/Finishes/Paints
- Resinous floor systems
- Access Flooring

- Interlocking Flooring
- Static Control Flooring

While SEFA attempts to provide professionally appropriate information to manufacturers, specifiers and users, it is the sole responsibility of manufacturers, specifiers and users to determine the appropriateness of the information and interpretations of it for their use in determining which products and guidelines are appropriate for their intended uses.

2.0 Performance Criteria

2.1 Chemical Resistance

Users should consider the chemical and staining agents that might be used in the laboratory. Common guidelines can be found by referring to: The work surface manufacturer printed data for chemical and stain resistance, NEMA LD3-2000 for wood product chemical resistance, ASTM D3023 and ASTM C1378 for stain resistance or the most current versions. Because chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping and other factors, it is recommended that users test samples in their actual environment with the substances they use.

2.1.1 Chemical Resistance Test

The purpose of the chemical stain resistance test is to evaluate the resistance a floor material has to chemical spills.

Test Method A – For volatile chemicals – A cotton ball, saturated with the test chemical, was placed in a one ounce bottle (10mm x 7mm test tube or similar container). The container was inverted on the test material surface for a period of 24 hours. Temperature of test: 23° +/- 2°C (73° +/- 4°F). This method was used for the organic solvents.

Test Method B – For non-volatile chemicals – Five drops (1/4cc) of the test chemical were placed on the test material surface. The chemical was covered with a watch glass (25mm) for a period of 24 hours. Temperature of test: 23° +/- 2°C (73° +/-4°F). This method was used for all chemicals listed below other than solvents.

Test No.	Chemical Reagent	Test Method
1.	Acetate, Amyl	A
2.	Acetate, Ethyl	A
3.	Acetic Acid, 98%	B
4.	Acetone	A
5.	Acid Dichromate, 5%	B
6.	Alcohol, Butyl	A
7.	Alcohol, Ethyl	A
8.	Alcohol, Methyl	A
9.	Ammonium Hydroxide, 28%	B
10.	Benzene	A
11.	Carbon Tetrachloride	A
12.	Chloroform	A
13.	Chromic Acid, 60%	B
14.	Cresol	A
15.	Dichloracetic Acid	A
16.	Dimethylformamide	A
17.	Dioxane	A
18.	Ethyl Ether	A
19.	Formaldehyde, 37%	A
20.	Formic Acid, 90%	B
21.	Furfural	A
22.	Gasoline	A
23.	Hydrofluoric Acid, 37%	B
24.	Hydrofluoric Acid, 48%	B
25.	Hydrogen Peroxide, 30%	B
26.	Iodine, Tincture of	B
27.	Methyl Ethyl Ketone	A
28.	Methylene Chloride	A
29.	Monochlorobenzene	A
30.	Naphthalene	A
31.	Nitric Acid, 20%	B
32.	Nitric Acid, 30%	B
33.	Nitric Acid, 70%	B
34.	Phenol, 90%	A
35.	Phosphoric Acid, 85%	B
36.	Silver Nitrate, Saturated	B
37.	Sodium Hydroxide, 10%	B
38.	Sodium Hydroxide, 20%	B
39.	Sodium Hydroxide, 40%	B
40.	Sodium Hydroxide Flake	B
41.	Sodium Sulfide Saturated	B
42.	Sulfuric Acid, 33%	B
43.	Sulfuric Acid, 77%	B
44.	Sulfuric Acid 96%	B
45.	Sulfuric Acid, 77% & Nitric Acid, 70% equal parts	B
46.	Toluene	A
47.	Trichloroethylene	A
48.	Xylene	A
49.	Zinc Chloride, Saturated	B

2.1.2 Acceptance Level

After 24-hours exposure, exposed areas were washed with water, then a detergent solution and finally with isopropyl alcohol. Materials were then rinsed with distilled water and dried with a cloth.

Samples are numerically rated as follows:
0 – No Effect – No detectable change in the material surface.
1 – Excellent – Slight detectable change in color or gloss but no change in function or life of the surface.
2 – Good – A clearly discernible change in color or gloss but no significant impairment of surface life or function.
3 – Fair – Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time.

Results will vary from manufacturer to manufacturer due to differences in composition and finish formulations and applications processes. Individual test results for the specified 49 reagents will be verified with an established third party independent SEFA 3 test submittal form. Suitability for a given application is dependent upon the chemicals used in a given laboratory.

2.2 Abrasion and Scratch Resistance

Users should consider the likelihood of uses causing abrasion, wear or scratches to the floor surface. Common guidelines are found in ASTM D4060 (Standard Test Method For Abrasion Resistance Of Organic Coatings By The Taber Abraser), ASTM F510 (Standard Test Method for Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with Grit Feed Method), ASTM C241 (Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic), ASTM C1243 (Standard Test Method for Relative Resistance to Deep Abrasive Wear of Unglazed Ceramic Tile by Rotating Disc)

Abrasion resistance of stone can be tested with a number of methods, including the European standard EN 14157 (EN 14157 2017) and the US standard ASTM C 241-90 (ASTM C 241–90 2005).

2.3 Ease of Cleaning

While a regular schedule of maintenance and housekeeping is always recommended including cleaning up spills immediately, some laboratories, e.g., those working with pathogens and radioactive isotopes, may be required to select non-porous materials and smooth surfaces for their lab flooring. Common guidelines include ASTM D4488, ASTM G122 and NEMA LD3-3.4-2000.

Standard Test Method for Measuring the Hard Surface Floor-Cleaning Ability of Household/Commercial Vacuum Cleaners

D5343-06(2018)
Standard Guide for Evaluating Cleaning Performance of Ceramic Tile Cleaners

2.4 Impact Resistance

Users should consider the likelihood of uses causing damage due to impacts. Common guidelines are found in ASTM D2794 (Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

2.5 Slip Resistance

Users should consider the slip resistance characteristics of the flooring surface. Testing generally involves measuring the coefficient of friction of the surface of the flooring material. The higher the coefficient of friction, the better the slip resistance. A common guideline is ASTM D2047 (Standard Test Method For Static Coefficient Of Friction Of Polish-Coated Flooring Surfaces As Measured By The James Machine). Testing can be done either dry, wet, or with some other contaminant, such as grease, oil or hydraulic fluid. Test results provide the user with a relative scale of the slip resistance of the flooring. A common guideline for the slip resistance of flooring is a coefficient of friction of 0.7 or higher.

In environments where the footwear can be controlled for specific needs, the user should also consider the slip resistance of the particular footwear with the specified flooring. A common guideline for this is ASTM F2913 (Standard Test Method for Measuring the Coefficient of Friction for Evaluation of Slip Performance of Footwear and Test Surfaces/Flooring Using a Whole Shoe Tester)

2.6 Dynamic Rolling Load Resistance

Users should consider the effects of dynamic rolling loads on the performance of the flooring system. Common guidelines include ASTM F2753 (Standard Practice to Evaluate the Effect of Dynamic Rolling Load over Resilient Floor Covering System).

2.7 Bacterial Resistance

Users should consider the ability of the flooring system to resist bacterial growth. Useful guidelines for assessing a flooring materials resistance to bacteria include ASTM E2180 Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials; ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi, and ISO 846 Plastics – Evaluation of the action of microorganisms.

2.8 Spill Containment/Seamless Construction

Users should consider the ability of the flooring system to contain spills. Resinous floor coverings can be applied in a monolithic coating that covers the entire floor and can be applied up the walls to create an effective spill containment system. Keep in mind that any cracks that develop due to shifts or cracks in the underlying subfloor will create the potential for liquids to leak through the floor. Resilient sheet vinyl or rubber can also provide an effective spill containment system. Sheets of flooring materials are glued to the subfloor and seams between the sheets are welded together to provide a liquid-tight system. Sheet material can also be applied up the wall to create an effective spill containment system.

2.9 ESD Protection

Users should consider the requirements for protection against electrostatic discharge (ESD). Static charges are developed when a person walks across a floor and when rolling equipment is rolled across the floor. ESD can damage sensitive electronics, disrupt data, and ignite explosives. ESD protective flooring is designed to either minimize the charges that are generated, or drain generated charges to ground, or both. For electronics handling a common guideline is ANSI/ESD S20.20 (Protection Of Electrical And Electronic Parts, Assemblies And Equipment). For areas with data processing equipment, a common guideline is Motorola R56 (Standards and Guidelines for Communication Sites). For areas with a danger of explosives, a common guideline is NFPA 77 (Recommended Practice On Static Electricity).

3.0 Environmental Considerations

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- Material Composition
    - Renewable

    - Recylable
    - Recycled Content
- Recyclability and Reusability
    - Take Back Programs
- Indoor Air Quality
    - Low VOC
        - FloorScore
        - CA Protocol 3150
        - Low VOC Adhesives or No Adhesives
    - Durability and Longevity
    - Life Cycle Assessments (LCA)
        - HPD
        - EPD
    -
- Certifications
    - LEED Considerations
        - Materials and Resources
            - Environmental Product Declarations
            - Responsible Sourcing of Raw Materials
            - Extended Producer Responsibility
            - Bio-based Materials
            - Wood Products
            - Materials Reuse
            - Recycled Content
            - Local Sourcing
        - Indoor Environmental Quality
            - Low Emitting Materials
    - Declare
    - Mindful Materials
    - Cradle-to-Cradle Certification

4.0 Lab-Grade Performance Requirements by Lab Type

The required attributes for flooring will depend on the type of laboratory. Table 4-1 provides a summary of the attributes that are required for a flooring material to be considered Lab-Grade for a particular laboratory type.

5.0 Flooring Types

5.1 Sheet Vinyl

Sheet vinyl flooring is typically offered in 6 feet and 2 meter widths for commercial and residential spaces.

Homogeneous sheet vinyl is made of a single layer and is sometimes referred to as through-color, meaning the color and visual on the surface goes all the way through the floor. This gives the flooring rigidity and toughness along with vibrancy and depth of color. Hence, it can be used in places that experience heavy foot traffic. This type of flooring is typically available in solid colors and multi-color chip configurations. It is incredibly durable and stain resistant which makes it a great flooring choice for heavy traffic areas. Products are commonly available with specialty top coats , such as urethanes, for added durability and improved maintenance characteristics.

- A proven product for health care and education applications.
- True through-color construction provides even wear and a consistent appearance over time.

- Durable performance even under heavy rolling loads.
- Products provide ease of cleaning, superior damage and abrasion resistance.
- Seams can be heat welded which fuses the product together creating strong, clean, seams which aids in infection prevention.
- Product can be flash coved for more efficient cleaning to help with infection control and spill containment.

Heterogeneous sheet vinyl features a multi-layer construction with a wear layer which may provide a printed image or consists of solid chips made from vinyl resin providing endless design possibilities, lasting performance, and low maintenance cost. A layer of foam may be included for underfoot comfort which reduces impact noise and sound transmission and provides added flexibility for ease of handling and installation. Depending on the construction, these products are typically used in commercial, light commercial, residential, and multi-family applications.

Products come with either a fiberglass, felt or foam backing. Fiberglass-backed sheet vinyl can be installed without glue, or as a modified loose-lay product using minimal adhesive.

Felt and foam-backed products are applied to the subfloor with the use of an adhesive.

- Technological advancements provide authentic wood and stone visuals and patterns that reflect popular design trends in higher-end products like stone, tile, and hardwood.
- Available in wide widths for a seamless installation that provides excellent top-down moisture protection.
- Commercial grades of heterogeneous sheet vinyl flooring offer not only superior durability but also attractive design alternatives.
- Warm, quiet and beautiful.

5.2 Rubber

Available in sheets or tiles, this resilient flooring option is sleek, contemporary, and comfortable underfoot. Colors, which are contained throughout the thickness of rubber flooring, vary from earthy to bright and run all the way through for a hue that won't fade or wear. The surface texture can vary from smooth marbleized or chip designs to many raised textures, including circular, square, flagstone, hammered or diamond-plate patterns and many others. Rubber has long been a solution for high-traffic settings that demand a durable material, resistance to water and burns, and is easy to clean and install.

With waterproof and slip-resistant properties that make it ideal for harsh environments that require frequent or harsh cleaning, rubber flooring is commonly used in institutional and commercial facilities. Some rubber tiles are engineered to work in areas where petroleum products, animal fats, and vegetable oils are present to provide a safe work environment. Rubber flooring is an excellent alternative, if you're looking for something durable, quiet, and warm to walk on. In the past, rubber floors were appreciated for durability over beauty, but today's rubber flooring can be as dazzling as any other type of resilient flooring choice. Rubber typically has a higher initial cost but lasts for a very long time. With its natural resilience and strength, rubber flooring is often used in high impact commercial and industrial areas including fitness centers, healthcare applications, and education facilities.

With advancements in colors, designs and textures, rubber flooring is increasingly popular in office and residential settings. A popular option for garages, rubber is also ideal for hardworking areas such as kitchens, baths, entries, and exercise rooms.

There are several variations of rubber flooring including natural rubber, synthetic rubber and recycled rubber. Different versions of rubber flooring exist for a number of situations including fatigue resistance in areas where people are standing or walking for long periods and heavy traffic floor stress in industrial environments. Rubber flooring products are available in sheet form and tiles.

Benefits of rubber flooring include:

- Durability – Rubber is strong, tough, and resilient under a variety of conditions. Properly cared for rubber flooring can last for 20 years or more.
- Resistant to motor and cooking oils – excellent product in environments where oil and grease are factors such as auto shops and food preparation areas.
- Easy Maintenance – Cleaning rubber flooring generally requires no more than a damp mopping.
- Softness – Despite its durability, rubber is soft underfoot, one of its important features for active health clubs and fitness centers.
- Water-resistant – Most rubber flooring is highly resistant to damage from moisture on both the top and bottom surfaces of the material.
- Quiet – The elasticity of rubber flooring makes it very quiet to walk on. Heels don't click, and dropped objects land softly.
- Excellent slip resistance.

5.3 Linoleum

Invented in the 1860s – with a number of improvements since then – linoleum as a floor covering has been largely replaced with vinyl flooring which has similar properties of flexibility and durability but with greater brightness and translucency. The term "linoleum" is often misused for other types of resilient sheet flooring, such as homogenous vinyl sheet. The compositions of these materials, however, are very different. Linoleum is made from all natural ingredients. Included in these natural ingredients are linseed oil, wood flour, limestone, cork, and tree resins. Linseed oil is derived by pressing flaxseed that is dried and ground into a powdery binder. This is combined with limestone, which is extremely abundant, pine resin, and cork and wood flours to form a doughy material to which color is added. Once pressed, it is rolled onto a jute backing and dried. Jute is spun from fibers of jute plants.

Linoleum is available in both tile and sheet form. Tiles often include an added layer of fiberglass for added dimensional stability.

Characteristics of linoleum flooring include:

- An all-natural, bio-based, renewable construction: linseed oil, jute, cork powders, and tree resins
- Very durable, withstands heavy traffic and scratches, and lasts for decades
- Available in a wide variety of colors
- Colors and patterns run all the way through
- Available in sheets or tiles
- Sheet linoleum lends itself to vibrant designs through borders and insets.
- Soft in feel and warm to the touch.
- Through-pattern wear layer provides durability and a consistent long-lasting wear appearance.
- Colorfast – even as it naturally wears down over time the hue found on the surface of the floor does not fade.
- Abrasion and gouge resistant.
- Naturally insulating and light-reflective colors.
- Resistant to alcohol-based hand sanitizers.
- Biodegradable – linoleum will decompose over time without releasing harmful gasses or toxins into the air.
- Natural, antibacterial properties.

5.4 Vinyl Composition Tile

Vinyl Composition Tile (VCT) is a finished flooring material used primarily in commercial and institutional applications. VCT is a popular choice due to its low cost and durability. The tiles can be used in a wide range of color and design combinations to create unique, custom effects. The durable through-color construction provides years of lasting beauty. VCT is an economic, commercial grade product built to last. That, paired with the low cost of VCT installation and the ease of maintenance, makes VCT an attractive option for a variety of commercial applications. Millions of square feet of this well-known product have been installed in retail stores supermarkets, hospitals, and schools.

The primary raw material in VCT is limestone which is a natural, highly abundant ingredient. Vinyl and color pigments are added to provide product flexibility and design. These products, composed of polyvinyl chloride (PVC) chips, limestone, other fillers, a thermoplastic binder and color pigments are formed into sheets of varying thicknesses (1/8" is most common) by heat and pressure. The sheets are cut into floor tiles with the most common size being 12" x 12". VCT is composed of 85% North American limestone and has a very low carbon footprint and is recyclable which contributes to LEED credits and reduces environmental impacts through landfill diversion and the cost of waste disposal.

- Modular flexibility including large format shapes and sizes
- Long life value with true through-pattern VCT
- Withstands heavy foot and rolling load traffic
- Many products include a factory finish that makes initial maintenance quick and easy
- Budget-friendly value with a history of great performance

5.5 Ceramic

Ceramic tiles are thin, flat tiles that are usually shaped with beveled edges. They may provide corrosion resistance, thermal protection, wear resistance, and/or surface decoration. Ceramic tiles come in many different shapes, sizes, and colors. They are secured to a surface such as a subfloor with mortar. The spaces between the tiles are filled with grout. In flooring applications, cross-shaped plastic spacers are used to separate the tiles prior to grouting.

Types

There are many different types of ceramic tiles, both in terms of categories and features. Examples include: waterproof

- mosaic
- ribbed
- vitrified
- quarry
- saltillo
- terra-cotta
- earthenware
- stoneware

Applications

Ceramic tiles are durable and hard wearing. Most ceramic tiles are categorized by the Porcelain Enamel Institute (PEI) according to their wear resistance. For example, PEI Class 1 tiles are only for wall applications; they are not suitable for foot traffic. PEI Class 2 tiles can handle light traffic, such as in residential bathrooms. PEI Class 3 tiles can handle light-to-moderate traffic, and are suitable for residential floors. PEI Class 4 tiles are for moderate-to-heavy traffic, and can be used in medium commercial or light industrial settings. PEI Class 5 tiles can handle heavy to extra-heavy traffic, making them suitable for all types of commercial and industrial floors.

Ceramic tiles are rated for scratch hardness according to the Mohs scale, which was named after German mineralogist Friedrich Mohs. The Mohs scale measures the ability of ceramic tiles to withstand scratches from a variety of minerals, ranging from the softest (talc) to the hardest (diamond). Ceramic tiles that are designed for residential use typically have a rating of 5. Ceramic tiles that are designed for industrial or heavy traffic areas have a rating of 7 or higher.

Specifications

Manufacturers of ceramic tiles may use proprietary mixtures of elements to make products. Typically, however, all of these mixtures include clay mixed with sand, feldspar, quartz, and water. All of these ingredients are mixed in a mill to create a substance called body slip. The body slip contains approximately 30% water at this point, until it is heated and dried to reduce the moisture content to about 6%. The body slip has the appearance of dust or powder and is compressed into the ceramic tile shapes using a high pressure electric or hydraulic press.

After pressing, the formed tile shape is called bisque. The bisque tiles are dried to remove the remaining moisture. Some ceramic tiles remain unglazed, but most are glazed using a glassy substance that contains a mix of pigments that give the ceramic tiles their color and surface characteristics. Glazed ceramic tiles are fired in tunnel kilns or roller-hearth kilns at temperatures of approximately 2000º F, permanently fusing the glaze to the surface of the tile.

There are two special types of ceramic tiles for use outdoors. Vitrified tiles have been treated to have very low porosity, making them strong and stain resistant. Impervious or porcelain tiles are fired at very high temperatures, making them very dense. Porcelain ceramic tiles have a high impact resistance to minimize breakage. Both vitrified and porcelain ceramic tiles are able to withstand the freezing and thawing conditions of outdoor applications. Other specialty types include pre-grouted ceramic tiles, which come from the manufacturers in large, pre-assembled sheets for quick installation.

5.6 Porcelain

Porcelain and quarry tiles are made from a clay mixture that's fired in a kiln. Porcelain tile is made from more refined clay and it's fired at higher temperatures. This makes it denser and more durable than ceramic tile.
Ceramic tile is usually created by mixing a base of clay with different types of minerals and water. A stoneware clay body will be fired at around 1,800-2,000°F and have water absorption between 0.5%-3.0%, with some even as high as 20%.
Porcelain tile on the other hand is made out of a mixture of clay, sand, and feldspar. Feldspar is a naturally occurring mineral in granite. The sand strengthens the mixture, while the feldspar melts, fusing together all the materials making the tile denser than a standard ceramic tile, thus stronger (30% stronger than granite!) and more stain resistant. Porcelain tile will be fired at a temperature up to 2,300°F. The higher firing temperature will drive out more water, and with the feldspar melting to form a low-order glass, the tile will be far more impervious. The American standards as set by the TCNA (Tile Council of North America) for a porcelain product is that it must absorb less than or equal to 0.5% of water.
The difference is in the body.

- Both can have a ceramic glaze, the difference is in the body. There are both un-glazed and glazed porcelains.
- The PEI rating is for the hardness of the glaze or surface of the tile and does not pertain to whether it is porcelain or ceramic.
- The tile industry traditionally has described porcelain tile as being a practically impervious form of ceramic tile, meaning that the tile will absorb equal to or less than 0.5% of water.

What are the benefits of porcelain body tile?

- Greater body strength of the tile and less likely to crack.
- Freeze/thaw resistance - makes porcelain a great choice for outdoor use.
- With porcelain body tile there is less expansion and contraction of the floor.

5.7 Quarry Tile

Quarry tile is a building material, usually 1⁄2 to 3⁄4 inch (13 to 19 mm) thick, made by either the extrusion process or more commonly by press forming and firing natural clay or shales.[1][2] Quarry tile is manufactured from clay in a manner similar to bricks.[3] It is shaped from clay, and fired at a high temperature, ~2,000 F°.[3]

The most traditional size in the US is nominally 6 in × 6 in × 1⁄2 in thick. Other common sizes include 4 in × 8 in and 8 in × 8 in.

In the UK, traditional surface dimensions generally vary from 6 in x 6 in, to 12 in x 12 in. Such tiles, given the generally local and non-standardized production, commonly vary between those dimensions, but rarely stray outside of them.

Modern quarry tiles are generally thinner than their historic counterparts, sometimes as thin as 8mm; by comparison, older tiles were rarely thinner than 3/4 in and could be as thick as 1 1/4 in thick.

Additionally, modern tiles can be found in different shapes, such as rectangular.

Traditional quarry tiles were unglazed and either red, grey, black/ very dark blue; however, modern "decorator" tiles come in a variety of tints and finishes. Industrial quarry tile is available with abrasive frit embedded in the surface to provide a non-slip finish in wet areas such as commercial kitchens and laboratories.

Quarry tile is extensively used for floors where a very durable material is required. It can be used either indoors or outdoors, although freeze-resistant grades of tile should be used outdoors in climates where freeze-thaw action occurs. Quarry tile is used less often as a wall finish and is occasionally used for countertops, although the wide grout joints can make cleaning of countertops difficult. Most commercial kitchens require a quarry tile to be used because of its slip resistant and non-porous properties.[4]

Quarry tile is usually set in a thick bed of cementitious mortar. The joints between tiles are usually grouted with cementitious grout. Grout joints are traditionally about 3⁄8 inch in width. Matching trim shapes such as coves, bases, shoes, and bullnoses are available to turn corners and terminate runs of the tile.

For traditional/historic applications, tiles were generally laid in lime mortar, doubling as grout, and with very fine grout joints (sometimes butted without joints, similarly to mosaic tiles).

Due to the typically square shape, quarry tiles were historically, and still today, restricted to either square or diamond patterns.

0. ^ "Archived copy". *Archived from* the original *on March 20, 2014*. Retrieved February 21, 2014. National Tile Contractors Association
1. ^ American Society for Testing and Materials Standard ASTM C 242
2. ^ Jump up to:a b "What is Quarry Tile - Metropolitan Ceramics". *9 April 2021.*
3. ^ "Hygienic Industrial Antacid Flooring and Applications". Thursday, 1 April 2021

5.8 Polished Concrete

Polished concrete is made in a multi-step process where a concrete floor is mechanically ground, honed and polished with bonded abrasives in order to cut a concrete floor's surface. It is then refined with each cut in order to achieve a specified level of appearance.

This process also includes the use of a penetrant chemical known as a hardener. The concrete hardener penetrates into the concrete and creates a chemical reaction to help harden and dust-proof the surface. During concrete polishing, the surface is processed through a series of steps (in general a minimum of four grinding steps of processing is considered polished concrete) utilizing progressively finer grinding tools. The grinding tools are progressive grits of industrial diamonds in a bonded material such as metal/hybrid/resin often referred to as diamond polishing pads. Polished concrete is a "green" flooring system and LEED approved.[1] Concrete is not considered polished before 1600 grit, and it is normally finished to either the 1600 or 3000+ grit level. Dyes designed for concrete polishing are often applied to add color to polished concrete as well as other options such as scoring, creating radial lines, grids, bands, borders, and other designs. Any grinding under 1600 grit is considered a honed floor.

Polished concrete floors have the following advantages:

- low-maintenance[citation needed] – polished concrete is easily maintained with the use of clean water or a neutral pH cleaner. There are also many cleaners designed for the proper maintenance of polished concrete available. There is never a need for wax to be added as it will only dull the finish
- non slippery – due to high coefficient of friction
- dust-proof – minimizing risks dust mite and allergen problems; excludes support of mold growth
- ambient light – highly reflective polished concrete reduces lighting needs and can improve natural lighting

5.9 Floor Coatings/Finishes/Paints

Paints and resinous coatings are applied to concrete floors in thin coats. The primary advantages of these materials are ease of application and coverage over a wide area. These have a longer usable life than floor finishes but less than permanent floor systems. Paints and coatings tend to wear off in time and must be reapplied periodically. Some materials are not applicable for cleanrooms because the materials abrade, chip away, or are highly loaded with carbon or volatile organic compounds (VOCs).

5.10 Resinous Floor Systems

Resinous floor system generally consist of materials that are mixed on site and chemically cure to form a durable, seamless floor covering. The most common materials used in the market are epoxy and urethane. Urethane systems generally have higher durability and thermal shock resistance.

Because they are mixed, and cure on-site, proper installation techniques are required to ensure proper performance. Generally, installers have special training and certification.

Resinous floor systems are often formed in several layers, commonly including:

- a base layer that provides resistance to moisture and thickness to cover irregularities in the subfloor; often 1/8” thick or more.
- A finish layer that provides the finished color and wear surface.
- Materials can be added to the finished layer to provide enhanced slip resistance

Benefits of resinous floor systems include:

- Chemical resistance
- Ability to withstand heavy vehicle traffic
- Seamless, including the ability to be installed up the wall to provide a seamless cove base
- Because epoxies are manufactured, on-site, proper installation techniques are critical to the successful performance of this type of material
- Good cleanability

5.11 Interlocking Flooring

There are now several interlocking options of many of the various types of flooring suitable for laboratory use, primarily interlocking versions of vinyl tile and rubber tile. There are also various interlocking mechanisms available. Interlocking mechanisms have varying degrees of liquid-tightness and all have seams. Benefits of interlocking flooring include:

- Generally require less subfloor preparation, can often be installed over an existing floor, and therefore offer much less downtime in a renovation.
- Many types can be easily disassembled and moved and are therefore useful for temporary needs

5.12 Access Floor Systems

A raised floor (also raised flooring, access flooring, or raised-access computer flooring) provides an elevated structural floor above a solid substrate (often a concrete slab) to create a hidden void for the passage of mechanical and electrical services. Raised floors are widely used in modern office buildings, and in specialized areas such as command centers, Information technology data centers and computer rooms, where there is a requirement to route mechanical services and cables, wiring, and electrical supply.[1] Such flooring can be installed at varying heights from 2 inches (51 mm) to heights above 4 feet (1.2 m) to suit services that may be accommodated beneath. Additional structural support and lighting are often provided when a floor is raised enough for a person to crawl or even walk beneath.

In the U.S., underfloor air distribution is becoming a more common way to cool a building by using the void below the raised floor as a plenum chamber to distribute conditioned air, which has been done in Europe since the 1970s.[2] In data centers, isolated air-conditioning zones are often associated with raised floors. Perforated tiles are traditionally placed beneath computer systems to direct conditioned air directly to them. In turn, the computing equipment is often designed to draw cooling air from below and exhaust into the room. An air conditioning unit then draws air from the room, cools it, and forces it beneath the raised floor, completing the cycle.

An alternative approach to raised floor evolved to manage underfloor cable distribution for a wider range of applications where underfloor air distribution is not utilized. In 2009 a separate category of raised floor was established by Construction Specifications Institute (CSI) and Construction Specifications Canada (CSC) to separate the similar, but very different, approaches to raised flooring. In this case the term raised floor includes low-profile fixed-height access flooring.[3] Low-profile fixed-height access flooring is useful where there is a need to quickly and easily accommodate changes of technology and floor plan configurations. Underfloor air distribution is not included in this approach since a plenum chamber is not created. The low-profile fixed-height distinction reflects the system's height ranges from as low as 1.6 to 2.75 inches (41 to 70 mm); and the floor panels are manufactured with integral support (not traditional pedestals and panels). Cabling channels are directly accessible under light-weight cover plates.

5.13 Static Control Floor Systems

Static Control Floor Systems are designed to reduce the generation of charges, drain generated charges to ground, or both. These functions are primarily achieved by adding conductivity to the flooring material and connecting the flooring material to ground. As such, static control flooring is always considered a system where several components make up the complete path to ground. For example, a glue-down tile system consists of the conductive tile, the conductive adhesive and a grounding connection. If a finish is applied, the finish would also be considered part of the overall system. A common failure mechanism of static control flooring systems is the application of a standard, insulative wax on a static protective floor. The wax creates an electrically insulating barrier that breaks the electrical path to ground.

Static control flooring systems that would be used in a laboratory environment come in many types and styles. These include:

- Vinyl Tile and Sheet
- Rubber Tile and Sheet
- Linoleum Tile and Sheet
- Vinyl Composite Tile
- Interlocking Tile
- Paints and Coatings
- Resinous Floor Systems

ESDA TR7.0 provides detailed descriptions of the types of static control flooring systems available, their uses, and the methods of testing their static control properties.

6.0 Installation Guidelines by Flooring Type

6.1 Vinyl, Rubber, and Linoleum Flooring

These flooring products are glued down to provide high performance in areas with heavy foot and rolling load traffic.
Installing a vinyl sheet floor is a very exacting process that requires excellent cutting and seaming skills, and subfloor knowledge. Professional installation by a reputable flooring dealer is highly recommended and may save money in the long run.

Gluing flooring materials requires proper preparation of the subfloor to ensure a proper bond. ASTM F710 provides guidance for preparing concrete floors to receive resilient flooring.

6.2 Vinyl Composition Tile

VCT for commercial applications requires the use of an appropriate adhesive as specified by the manufacturer.

6.3 Ceramic and Porcelain Tile

Specialized cement is necessary for installation of porcelain tiles, and in the US specifications, are set by the Tile Council of America[1] and supported by the Tile Contractors Association.

7.0 Care and Maintenance Guidelines

7.1 General Maintenance

D4386-95(2016)
Standard Practice for Application of Floor Polishes to Maintain Multilayer Composite Tile or Flooring

7.2 Protective Finishes

7.3 Reagents

7.4 Removal of Stains

7.5 Extreme Temperatures

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Column1	BSL1-2	BSL3-4	Chemistry/ General	Chemistry/ Organic	Physics	Cleanroom	Vivarium ABSL 1&2	Vivarium ABSL 3&4	Engineering/ General	Workshops	Electronics	Trace Metals	Computational	K-12
Chemical Resistance	No More Than 4 Level 3 Conditions	No More Than 4 Level 3 Conditions	No More Than 4 Level 3 Conditions	No More Than 4 Level 3 Conditions		No More Than 4 Level 3 Conditions	No More Than 4 Level 3 Conditions	No More Than 4 Level 3 Conditions			No More Than 4 Level 3 Conditions	No More Than 4 Level 3 Conditions		No More Than 4 Level 3 Conditions
Abrasion and Scratch Resistance	ASTM F510; ASTM C241; ASTM C1243													1
Ease of Cleaning	NHDRN, VDI 2083, ASTM D4828 ASTM	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828	NHDRN, VDI 2083, ASTM D4828
Impact Resistance									ASTM D2794	ASTM D2794				ASTM D2794
Slip Resistance	ASTM D2047/ UL 410													
Dynamic Rolling Load Resistance	ASTM F2753													
Bacterial Resistance	ASTM E2180/ ASTM G21	ASTM E2180/ ASTM G21	ASTM E2180/ ASTM G21	ASTM E2180/ ASTM G21			ASTM E2180/ ASTM G21	ASTM E2180/ ASTM G21						ASTM E2180/ ASTM G21
Spill Containment/Seamless Construction		Required					Required	Required						
ESD					ANSI/ESD S20.20	ANSI/ESD S20.20					ANSI/ESD S20.20		ANSI/ESD S20.20	