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# PERFORMANCE CHARACTERISTICS OF FABRICS

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**Abstract**
Optical properties of materials: shine, color, transparency are important performance characteristics. These indicators are taken into account when choosing a model, cutting, sewing products, the nature and pattern of the fabric.

**Keywords**: Color model, drawing, transparency, color, optical properties.

**Introduction**

Optical properties are properties perceived in visual sensations. The main optical properties include absorption, refraction, reflection and stratification by fibers and threads of light. The optical properties of fibers (threads) are determined by the structure of the electronic shells of the atoms that make up the molecules.[1]

The optical properties of materials, such as gloss, color, and transparency, are important characteristics that affect their performance. These parameters are considered when selecting a model, cutting, sewing products, and determining the nature and pattern of the fabric.

Optical properties are perceived through visual sensations. The main optical properties include absorption, refraction, reflection, and the stratification of light by fibers and threads. The optical properties of fibers (threads) depend on the structure of the electronic shells of the atoms that make up the molecules.

Gloss is a specific perception of light, consisting of specularly reflected and diffusely scattered radiation. The gloss of a fabric characterizes its ability to reflect incident light and depends on the degree of specular reflection: the higher this component, the stronger the gloss. The gloss of a fabric is directly related to its surface characteristics, which are determined by the structure of the threads, their twist, the type of weave, the arrangement of fibers and threads within the material, and the nature of the finishing on the front side. Additionally, surface gloss changes depending on the viewing angle and the positioning of specularly reflective areas.

A fabric is most visually appealing when it has a soft, moderate sheen. Depending on the purpose of the material, gloss can be either desirable or undesirable. Excessive shine can strain the eyes of people working with such fabrics or wearing garments made from them. Both an excessively glassy shine and a dull surface without luster can negatively impact the fabric’s appearance.

To enhance gloss during fabric production, smooth, profiled (flat or triangular) metallic threads are used, giving the fabric a shimmering effect (such as comelan or okelan). Weaves with elongated floats (satin, sateen, and basic twill) and finishing techniques like pressing, calendaring, polishing, varnishing, metallization, and mercerization can also be applied.

Additionally, using yarns that contain synthetic fibers with increased luster contributes to a shinier fabric.

To reduce gloss, conditions that increase light diffusion are created. For instance, titanium dioxide particles are introduced into the structure of synthetic fibers during spinning, enhancing diffuse scattering. Other methods include using weaves with frequent thread bending, fancy yarns and threads, textured bulk yarns, highly twisted threads, relief and pile weaves, and fiber matting. Certain finishing processes, such as backcombing, ratiné treatment, etching, corrugation, flocking, and final decatizing, also reduce shine by increasing surface roughness or altering the spatial arrangement of fibers.

Local gloss appears in fabric areas subjected to high pressure and friction during use. This effect is caused by the flattening of threads and wear of surface fibers, leading to increased specular reflection. Significant pressure during processing can align fibers in one plane, flatten threads, and create smooth areas with strong specular reflection. When exposed to moisture, heat, and pressure, these surface changes may become stable. To eliminate unwanted shine, products are treated with live steam while applying brushes (steaming).

Transparency characterizes a fabric's ability to transmit light, creating a perception of light passing through it, and provides insight into the material's thickness. This property is influenced by the transparency of the fibers and threads themselves, their density within the fabric structure, and the presence of through-pores that allow light to pass without deviation.

Depending on the material's density, the light passing between fibers undergoes multiple scattering and reflection from fiber surfaces. In loosely woven fabrics, such as openwork weaves with large through-pores, a portion of the light flux can pass through unchanged. Transparency is quantitatively assessed by the transmittance of light flux, which decreases as fabric thickness increases.

The greatest transparency is found in lightweight, loosely woven fabrics made from natural silk (e.g., chiffon, crepe georgette), thin cotton fabrics with open weaves (e.g., voile), and synthetic crepe fabrics with low linear density. Light-colored fabrics appear more transparent than similar fabrics in darker shades.

The color of a fabric is determined by the combination of all the colors involved in its pattern and can evoke different aesthetic perceptions depending on its tone, saturation, and brightness. Fabrics can be warm, cool, cheerful, somber, or seasonal in color. Identical patterns can appear entirely different based on their color scheme. Depending on fashion trends, seasonal changes, and other factors, garments may be made from fabrics with the same pattern but in different colors, altering their overall aesthetic impact.

In textile production, a wide variety of colors are used beyond primary colors. Popular colors include all shades of gray (from dark to light pearl), as well as white, black, green (sage, bottle green), chestnut, chocolate, beige, and delicate shades of blue and pink. Fabrics in brown, lead green, emerald green, blue, lilac, and black are always fashionable.

Natural silk is valued for its softness, fineness, pleasant moderate sheen, high durability, and good thermal insulation properties. It does not pill, withstands hand washing, and does not generate static electricity, distinguishing it from synthetic alternatives. However, silk has the lowest light resistance among natural fibers. Due to photochemical reactions under exposure to light and weather conditions, silk fibers yellow over time, and their mechanical properties deteriorate.

Considering all of the above, silk is a high-quality material with both advantages and certain drawbacks.

When cutting fabrics, it is essential to consider the pattern's characteristics and direction. The most challenging patterns to cut are checkered, striped, and large-scale designs, as they require precise alignment, leading to higher material consumption.

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