STRUCTURALLY-COLORED ARTICLES AND METHODS OF MAKING AND USING STRUCTURALLY-COLORED ARTICLES

BACKGROUND

Structural color is caused by the physical interaction of light with the micro- or nano-features of a surface and the bulk material as compared to color derived from the presence of dyes or pigments that absorb or reflect specific wavelengths of light based on the chemical properties of the dyes or pigments. Color from dyes and pigments can be problematic in a number of ways. For example, dyes and pigments and their associated chemistries for fabrication and incorporation into finished goods may not be environmentally friendly.

SUMMARY OF INVENTION

According to a first aspect of the present invention, there is provided an article of footwear or an article of sports equipment, comprising:

a film forming at least a portion of a component of the article, the film having a first film surface, a second film surface opposing the first film surface, and a film core between the first film surface and the second film surface, wherein the first film surface or the second film surface or the film core or any combination thereof include a film polymeric material, wherein the first

film surface forms an externally-facing surface of the component or an internally-facing surface of the component; and

an optical element disposed on the first film surface, on the second film surface, or within the film core, wherein the optical element has a first side and a second side opposing the first side, wherein the first side of the optical element, the second side of the optical element, or both, impart a structural color to the component;

wherein the optical element comprises one or more of a multilayer reflector and a multilayer filter

wherein the multilayer reflector has at least two layers, including at least two adjacent layers having different refractive indices, and at least one of the layers of the multilayer reflector has a thickness that is about one-fourth of the wavelength of visible light to be reflected by the optical layer structure to impart the structural color;

and wherein the multilayer filter destructively interferes with light that impinges upon the article so that a single wavelength of light, or a particular range of wavelengths of light, make up the structural color.

According to a second aspect of the present invention, there is provided a method of making a component of an article of footwear or an article of sports equipment, the method comprising:

disposing a first film surface onto an externally-facing surface of the component, wherein the film comprises a film polymeric material and the film has a second film surface opposed to the first film surface and a film core between the first film surface and the second film surface; and

wherein the first film surface or the second film surface includes an optical element having a first side and a second opposed to the first side, and the first side of the optical element or the second side of the optical element, or both, impart a structural color to the component;

wherein the optical element comprises one or more of a multilayer reflector and a multilayer filter

wherein the multilayer reflector has at least two layers, including at least two adjacent layers having different refractive indices, and at least one of the layers of the multilayer reflector has a thickness that is about one-fourth of the wavelength of visible light to be reflected by the optical layer structure to impart the structural color;

and wherein the multilayer filter destructively interferes with light that impinges upon the article so that a single wavelength of light, or a particular range of wavelengths of light, make up the structural color.

BRIEF DESCRIPTION OF THE DRAWINGS

Further embodiments of the present disclosure will be more readily appreciated upon review of the detailed description of its various embodiments, described below, when taken in conjunction with the accompanying drawings.

Figures 1A-1M illustrate footwear, apparel, athletic equipment, containers, electronic equipment, and vision wear that include the optical element of the present disclosure.