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MECHANO-OPTICAL BRILLIANT POLYMER COLOURS - NANOTECHNOLOGY PAVES THE WAY

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The opals, iridescent semi-precious stones, have brilliant colours without using any dyes. The colour is generated by a structure in the range of half the wavelength of visible light. This phenomena in nature, "colour without dyes", is also used in BASF's research for the production of brilliant colours:

Aqueous dispersions, containing monodisperse nanoparticles, are dried and form polymer opals producable in large areas.[1], [2] These polymer opals are mechanically stable and also flexible, if dispersions with core/shell-particles are used, having a soft, crosslinked core and an even softer polymer shell with a glass transition temperature far below room temperature. During the drying process the particles are face-centred-cubic ordered. The shell is forming the continuous matrix with high elasticity, whereas the core remains the crystalline order. Single crystals of elastic polymer opals with an area of 2 cm x 2 cm x 40 µm are available.[5]

Particle sizes of about 300 nm give a red colour at perpendicular view changing via green to blue at a more acute observation angle. Smaller particles are generating the colours with shorter wavelength like green or blue.[1]-[4] If the crystalline film is stretched, the particle distance perpendicular to the surface is reduced. Therefore the colour changes from red via green to blue or even to ultraviolet, if the film is stretched 30%, 60% or beyond. Reversible stretching above 300% of the original length is possible without destroying the crystalline order of the core particles, corresponding far more than one optical octave.[5]

The polymer opal is produced in large scale by self-assembly on a polypropylene foil and can easily be laminated to different surfaces.

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