Material Science: Fabric/Textiles

Title: Methods of Enhancing Dyeability of Polymers (UMD 02-02)

Inventors: Qinguo Fan et al.

Applications: Multiple uses including fibers, fabrics, films, plates, sheets, and bulk materials such as toys, utensils, appliances, furniture, and plastic tools as well as packaging materials.

Benefits:
- Increased ability to customize finished products
- Reduction of inventory costs and waste
- Enabling antimicrobial properties
- Ability to respond faster to fashion and market demands

Technology Description: The invention is based on the discovery that the dyeability of polymers, such as polyolefins, can be significantly enhanced by incorporating into the polymers a nanomaterial such as a nanoclay, nanosilica, metal oxide (e.g., zinc oxide, silver oxide, calcium oxide, platinum oxide), zeolite, or nanoparticles of polymers (e.g., polysiloxanes). The technology can produce a dyeable polypropylene by using nanoclay that is surface modified with cationic surfactants. The nanoclay is evenly distributed within the polypropylene matrix and provides desired dye affinity in the polymer system. The nanoclays are introduced to the polypropylene matrix in a melting or dissolving process with a combination of heat and/or organic solvent. This technology can easily be adapted to different processes, using mechanical blending, ultrasonication and/or screw mixing. This low cost process technology can be used to produce polypropylene fibers and fabrics with acid and disperse dyeability properties.


For both disperse and acid dyeing operations, color strength for PP nanocomposite materials is dramatically improved.

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PP = Unmodified PP fiber
NC2 = PP nanocomposite fiber 1
NC4 = PP nanocomposite fiber 2
NC6 = PP nanocomposite fiber 3
PET = Polyester fiber