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Review on self-cleaning materials and its applications in industries

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Abstract

Materials which possess property of cleaning dust from their surface are known as self cleaning materials. Natural surfaces like butterfly wings and lotus leaves also exhibits self cleaning property. Due to its tremendous application in industry now a day's researchers have attracted towards research on self cleaning materials. Though self cleaning materials are currently used, its market has high potential in nearest years, and will become largest category of smart materials for its revenue generation. With the advances in development and economy, problem associated with industrial pollutants becoming more serious. All these pollutants, dust, debris settles on exterior part of walls, which decreases its aesthetic looks. Majority of self cleaning material surfaces fall under two categories: Hydrophilic (in which water spreads over the surface forming the thin film) and Hydrophobic (in which water drop roll off quickly on the surface). In present communication we will try to elaborate present status of self cleaning materials and its applications in various industries.

Keywords: Self cleaning, hydrophilic and hydrophobic

Introduction

During last few years numerous works is carried out on self cleaning materials especially with reference to its durability and cost effectiveness. Because of unique properties and tremendous applications in the area of energy and environment, self cleaning materials have gained considerable attention. Natural surfaces like butterfly wings, fish scales and lotus leaves also exhibits self cleaning property. These coatings have wide variety of applications such as window glasses, cements, textile, paints etc. Self cleaning material surfaces fall under two categories, hydrophilic and hydrophobic. Both of these types are able to clean themselves when water is present.

The common case in nature is Lotus effect. Due to hydrophobicity of the lotus leaf water droplets can be seen on the surface of it. Such a hydrophobic coating has higher water of contact angle. Since these surfaces are highly water repellent, water tends to form spherical droplet and roll over on the surface and hence cleans it. Whereas hydrophilic self cleaning materials are based on the photo catalysis. When they are exposed to light they break downs the impurities. Mechanism of self cleaning is achieved by lotus effect, photo catalytic coating and by easy to clean finishing.

Paint industry

Paints are not only used to improve aesthetic look of exterior walls of building but also protects exterior walls of building from the effects of whether. In the regions with heavy rainfall and damp areas; outer walls of building suffers from corrosion, growth of moulds occurs on this damp area and ultimately decreases its aesthetic look. For such a surfaces self cleaning paints are extremely useful.

Textile Industry

Nanotechnology and nano-science provides new concept of self cleaning or anti stain fabric. Self cleaning fabric or textile enormous areas of applications such as for soldiers, astronauts, for military uniform, in hospital garments, as sport ware. Defence sector stands to benefit from such self cleaning fabric. Soldiers working in adverse area where they do not have luxury of washing clothes, this type of textile will certainly help them to maintain hygienic conditions. Advantage of this self cleaning fabric is it reduces laundry time and thereby become cost effective.

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It gives environmental protection since use of water resources is minimised and no detergent is required, hence consequently becomes cost effective as well as ultimate reduction in man hours. This technology helps to make textile long lasting. Fabric used in upholstery is difficult to clean; self cleaning textile may find application in such upholstery fabric. There are various ways for making textile self cleaning. There are various ways for making textile self cleaning as by surface roughening, by photo catalytic coating, above methods will not affect appearance of textile, its ability to breath and easy to maintenance; which will protect textile from water, dirt and stains.

Conclusions and future of self cleaning materials

Though today's self cleaning technology have some limitations future research and development might disperse this restrictions. Other than paint fabric and glass this technology can be applied to materials such as wood, concrete and metals which are Vulnerable towards environmental effects.

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