The effect of structural composion on self _ cleaning property of hand tuft carpet.

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Abstract:

Here in we present a self cleaning properties of carpet. TiO2 NPs is used to impart carpet material self-cleaning characteristics. When TiO2NPs is coated on carpet polymers, its inherent photo-catalytic activity decomposes the polymeric carpet materials, as well as the contaminants. Fabric material and its weaving construction are expected factors that able to mitigate the deterioration of mechanical strength of the treated fabrics under the photocatalytic activity of TiO2NPs. The present work aims at investigating the effect of self-cleaning treatment on some physico-mechanical properties of woven carpet by hand tuft method we were chosen three kind of woven constructions were namely, wool 3/1, polyester 1600 and wool/polyester blend. All this construction has different intensity, hight of pile and number of line pile /cm. The three kinde of carpet were treated with TiO2 NPs in presences of sodium hypophsifite as cross liking agent and citric acid as activating agent the studies appear that the best results:

The polyester samples is the best one and when the number of line /cm increase the self cleaning increase but the reverse happen with intensity of carpets.

Keywords:

Hand Tuft – Nanotechnology - Self-Cleaning.

Introduction

Carpet industry is considered one of the textile industries in which the embodiment of the environmental and civilizational reality is achieved where the elegance of any house is not complete except with a carpet that gives it warmth and highlights the luxury and beauty of its furnishings. Its beauty and value increase year after year, and a carpet is a world in itself with a long history that tells stories of the past and the present.

Substances that form dirt are many and complicated, and these materials are either solid materials such as sand that move quickly to the bottom of the pile and indulge in the floor of the carpet, and with frequent friction between these particles and vesicles of the pile, they work to quickly destroy the carpet. It resists all mechanical cleaning methods to remove it, or

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pigmented materials such as fruit juice that need severe treatments to be removed, which may eventually lead to deformation of the treated area as a result of removing the original color or part of it, if the proper methods of cleaning are not used**.**

The recent technological development has helped increase the functional efficiency of the carpet by controlling and changing its structural elements while using some treatments that led to achieving the best functional properties.

Nanotechnology has an effective role in that, as we find that covering the surface of furnishings with nanoparticles adds to the product properties, including: expelling water and oils - resisting dirt and dust - preventing bacteria - preventing the generation of static electricity - resisting flammability - color fastness.

Statement problem:

Woven floor furnishings, especially lintels, are a suitable place for dust accumulation and adhesion to stains, this may cause the urgent need for frequent washing and cleaning of these furnishings, which affects the appearance of the rug and reduces its consumption life, so it is a scientific study to adjust the elements of the structural composition of the carpet and treat it using technology of Nanoscale to achieve self- cleaning of carpets, it is an important study, the impact of which is reflected on the audience of carpets and rugs.

Significances:

1. Providing the carpet with the self-cleaning feature, in order to increase the carpet life and maintain its elegance.
2. Finding the most appropriate structural elements that achieve the highest cleaning with the best functional and mechanical properties.

Objectives:

1. Providing solutions to the problem of carpet cleaning by adjusting the structural composition of it.
2. Provide the carpet with a self-cleaning feature by treating it using modern nanotechnology.
3. Having carpets that have the ability to resist dust and stains to reduce the number of washing times and extend their lives.

Research hypotheses:

1. The type and nature of the materials used to produce carpets affect the self-cleaning property.
2. The structural composition of the carpets (the height and density of the pile in the square unit) affects the self-cleaning property.
3. Chemical treatments for carpets using different nanoparticles in different proportions affect the self-cleaning property.

Research Methodology:

The research follows the analytical experimental method.

A-<u>Theoretical Framework:</u>

Carpet (tuft) is one of the types of pile yarn floor covering. It is made automatically by taffeta system, where the thread of the pile is stitched into a textile layer prepared in an earlier stage (this layer may be woven or non-woven and called the primary back. backing) by using needles of a special kind to form the needle, and this needle may be closed loops or cut loops, and the

rug may in some parts contain closed loops and other parts have cut loop according to the required design [1].

1-Stages of production of carpet samples hand tuft carpet technique [2], [3], [4]

1-1 Preparing the loom.

1-2 Draw the design on the carpet floor.

1-3 Laying the design on the carpet floor.

1-4 Quality control of the rug after filling it with stitches.

1-5 Covering the back of the carpet with adhesive.

1-6 Back packaging.

1-7 Drying.

1-8 Shearing.

1-9 Engraving.

B-Practical experiences and laboratory tests

27 samples of carpets were produced in the technique of Hand Tuft Carpets with the following specifications, as shown in Table (1**):**

Table (1) indicates specifications for producing samples under research.

The sample number	samples specifications		
	Type of material	Pile height (mm)	Pile density (number of stitches / cm)
1	Wool	20mm	9 (stitches / cm)
2			6 (stitches / cm)
3			3 (stitches / cm)
4		16mm	9 (stitches / cm)
5			6 (stitches / cm)
6			3 (stitches / cm)
7		12mm	9 (stitches / cm)
8			6 (stitches / cm)
9			3 (stitches / cm)
10	Polyester	20mm	9 (stitches / cm)
11			6 (stitches / cm)
12			3 (stitches / cm)
13		16mm	9 (stitches / cm)
14			6 (stitches / cm)
15			3 (stitches / cm)
16		12mm	9 (stitches / cm)
17			6 (stitches / cm)
18			3 (stitches / cm)
19	Blended (Wool/Polyester)	20mm	9 (stitches / cm)
20			6 (stitches / cm)
21			3 (stitches / cm)

22		16mm	9 **(stitches / cm)**
23			6 **(stitches / cm)**
24			3 **(stitches / cm)**
25		12mm	9 **(stitches / cm)**
22			6 **(stitches / cm)**
27			3 **(stitches / cm)**

Self-cleaning degree of samples after treatment

- The percentage of the self-cleaning factor was calculated by using readings resulting from measuring the color depth before and after exposure to sunlight (as the presence of photosynthetic layers such as Nano titanium dioxide converts atmospheric air oxygen to active oxygen in the presence of sunlight, which breaks the organic matters dirt and stains), by the following equation**:**

$K/S=((B-T)/B) \times 100$

Where B is the color depth before exposure to sunlight.

Where T is the color depth after exposure to sunlight.

c-Summary of the results:

1- The best samples that achieved the highest percentage of self-cleaning were the blended samples, then the polyester samples and finally the wool samples.

2- The higher the number of rows of poison / poison, the more efficient the cleaning.

3- Self-cleaning efficiency is inversely proportional to the height of the pile.

E- References:

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