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HYDROPHOBIC COATING AND ITS APPLICATIONS

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ABSTRACT

The method proposed in this paper is an easy way to achieve hydrophobicity. The science behind this is the behavior of water molecules at a microscopic scale with a nano-rough surface. To form this coating we used these materials 1)Lacquer Spray (binder) 2)Room freshener (Hydrophobic agent). This coating has been tested successfully on the materials mentioned in this paper and can be used in the industry to save materials from getting wet.

Keywords—*Hydrophobicity; Contact angle; Nano Roughness; superhydrophobic*

I. INTRODUCTION (WHAT IS HYDROPHOBICITY?)

Hydrophobicity comes from the Greek word Hydro (water) and Phobia (fear). Hydrophobicity is commonly referred to them as a physical property of a material that repels a mass of water. The technical definition of hydrophobicity is used to refer to the transfer of nonpolar solutes into an aqueous solution [2].

II. HYDROPHOBIC COATING

A hydrophobic coating is a nanoscopic surface layer that repels water. Water droplets hitting this kind of coating can fully rebound. This coating can be used to protect the coated surface from getting wet which in turn will increase affordability and better protection from water.

III. CHEMICAL BONDING

To fully explain and quantify hydrophobicity, it is necessary to define the relationship between contact angle and the hydrophobic character of a surface.

How is hydrophobicity evaluated?

The evaluation of hydrophobicity is made through water contact angle measurement.

θc = Contact Angle

Hydrophilic surface:

- Surfaces with a contact angle θc< 90°
- Water spreads out on surface

Hydrophobic surface:

- Surfaces with a contact angle θc> 90°
- Water beads up on the surface

Superhydrophobic surfaces:

- Surfaces with a contact angle θc> 150° [1]

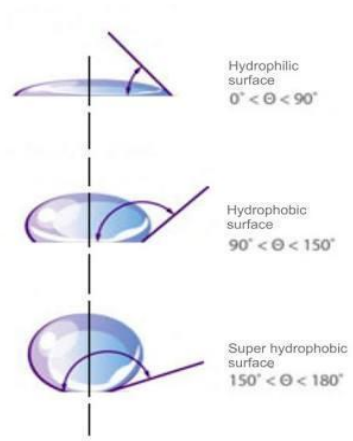

Figure 1: Angle of contact with different surfaces

IV. MATERIALS REQUIRED

1) Lacquer Spray (Binder).
2) Room Freshener (Hydrophobic Agent).
3) Cardboard box.
4) Water.
5) Glass.
6) Umbrella.

V. PROCEDURE

- First of all clean the surface on which we have to form the coating.
- No moisture should be present on the surface before applying the coating.
- Spray the binder (lacquer spray) on the required surface on the required surface (cardboard box here).
- Immediately after that spray the hydrophobic agent (Room Freshener here) on the required surface (cardboard box here).
- Leave the surface undisturbed and allow it to dry for about an hour.
- After an hour test the coating in following way.

- Pour some water on the area in which the coating is applied and also on the area where the coating is absent.
- Check if the surface soaks the coating.
- Observe the contact angle of water with the surface.

Figure 2: Coating is applied on the surface

Figure 3: Coating allowed to dry

VI.INSTRUCTIONS

- The surface should be cleaned with the help of a cloth before applying the coating.
- Masks should be used while applying the coating.
- In order to compare properly the hydrophobicity of the surface pour water which is coated as well as on the surface which is not coated with this coating, it will allow a better comparison of the same.

VII. OBSERVATIONS

While the lacquer was used there was a smell which was similar to the smell of new furniture. After an hour the coating had completely dry.

- When water was poured on surface which was coated the cardboard box did not soak any water. When water was poured on surface without the coat the surface got wet and the cardboard box absorbed some water.
- Later the same experiment was done on a transparent glass. The glass formed the same coating but the transparency of the glass was lost.
- The same experiment was also carried on a part of an umbrella. The part on which coating was applied did not soak any water but the water stayed on top of it. It can be removed easily as the surface did not got wet.

Figure 4: Water poured on the coating

VIII. WHY DOES THE COATING WORKS?

The hydrophobic interaction is mostly an entropic effect originating from the disruption of the highly dynamic hydrogen bonds between molecules of liquid water by the nonpolar solute forming a clathrate-like structure around the non-polar molecules. This structure formed is more highly ordered than free water molecules due to the water molecules arranging themselves to interact as much as possible with themselves, and thus results in a higher entropic state which causes non-polar molecules to clump together to reduce the surface area exposed to water and decrease the entropy of the system. The coat contains the lacquer and air freshener. The lacquer acts as a binder and the air freshener acts as a hydrophobic agent.

IX. APPLICATIONS

- Cardboard boxes **:** The coating can be given on the packaging cardboard boxes of various things such as television, shoes, microwave , etc. Many times during transport the boxes get wet, and the water is absorbed . Due to which the inside object may be affected . This coating will prevent it from absorbing water.
- Umbrella : After using an umbrella it needs to be dried as it gets wet. But if the umbrella is coated with this coating then the water is not absorbed and stays on the umbrella in the form of droplets and can be easily removed as the umbrella does not get wet.

Figure 5: Umbrella coated with hydrophobic coating (on the left side)

- Number plates of vehicles : When the number plate is exposed to water it can rust but with the help of this coating the water won't touch the surface as well as it won't let mud stick on it.

Figure 6: Rusted number plate of a vehicle

X. LIMITATIONS

- The spray takes a long time to dry.
- Leaves an unpleasant smell which when ingested in large quantity causes difficulty in breathing, nervous system damage and loss of vision. Which means extreme care should be taken while using lacquer.
- Lacquer can cause skin irritation when exposed to skin.
- It cannot be used on food products.
- Coating is not transparent.

XI. AREAS OF IMPROVEMENTS

- The coating should be made transparent so that it could be used on glasses of vehicles.
- A method needs to be implemented which allows the coating to dry faster.
- A way to eliminate lacquer fumes needs to be found to eliminate the fumes.

XII. CONCLUSION

With the help of this project we have demonstratedaneasy way to develop hydrophobicity on surface. This method is cost effective as well as can be used by untrained people as well. This method can be brought in a large scale use by using the coating in packaging industry which will reduce the use of plastic, as plastic is used to cover cardboard boxes from water. With the help of hydrophobic coating the boxes will not need any plastic coatings and they will not get wet and the goods will be safe. Also this method can be used to produce water repellent umbrellas.

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XIV. REFRENCES

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