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# Nano self-cleaning

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**Abstract**
Nano self-cleaning system review is presented in this paper. To achieve superhydrophobicity on a surface, it needs to be both rough and possess low surface energy. In this study, paraffin wax nanoparticles were used to create a hierarchically structured surface on cotton fabric, resulting in a superhydrophobic surface. Candle soot nanoparticles were also used to deposit superhydrophobic coatings onto smooth and micro-rough steel surfaces, demonstrating significant promise for use in high-temperature and corrosive environments. The coatings exhibited outstanding chemical and thermal stabilities, as well as effective self-cleaning abilities, making them ideal for industrial applications. Results from testing showed that the coatings created with 100 mg of candle soot nanoparticles in suspension were stable when hit by water jets, and demonstrated strong water repellent and self-cleaning qualities. This study provides an affordable and efficient technique for creating superhydrophobic coatings with a wide range of potential applications. The work done & presented in this paper is the result of the mini-project work that has been done by the first sem engineering students of the college and as such there is little novelty in it and the references are being taken from various sources from the internet, the paper is being written by the students to test their writing skills in the starting of their engineering career and also to test the presentation skills during their mini-project presentation. The work done & presented in this paper is the report of the assignment / alternate assessment tool as a part and parcel of the academic assignment of the first year subject on nanotechnology & IoT.
**Keywords:** Nanotechnology, Cleaning, Water, Jet, Corrosion.

## Introductory note

This paper examines the lotus effect and the superhydrophobicity of both natural and manufactured surfaces. The lotus effect is characterized by strong water repellency and self-cleaning due to surface roughness and low surface energy coating. Superhydrophobic polymeric surfaces have been researched extensively in the past decade for their potential uses in anti-corrosion, anti-fouling, self-cleaning, anti-icing, and drag reduction. The incorporation of physico-chemical principles in technical prototypes has led to the development of surfaces covered with hydrophobic wax crystals that have high contact angles and are self-cleaning [1]. The Lotus effect, also known as super-hydrophobic self-cleaning, has gained significant interest in recent years due to the need for hygienic, self-disinfecting, and contamination-free surfaces [2]. Studies have explored both hydrophobic and hydrophilic self-cleaning technologies, including photocatalytic action. Fabric modification through PDMS and paraffin wax coating at 120°C results in a superhydrophobic textile that is easily repairable, has micronano structures, and demonstrates good self-cleaning abilities [3]. Hydrophobic carbon soot particles placed at the center of a candle flame create superhydrophobic coatings that are characterized by their surface micromorphology, wettability, and self-cleaning abilities against solid and liquid contaminants [5]. Composite films of PVDF / DMF / candle soot particles demonstrate

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superhydrophobicity with high water contact angles and low roll off angles. The Fig. 1 gives the ideas of the nanoself cleaning materials [4].

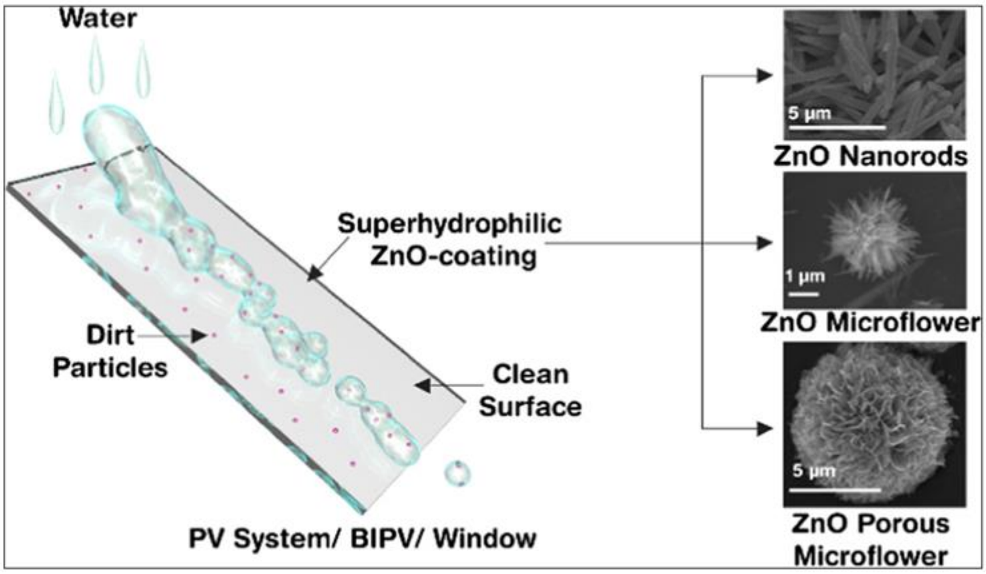


Fig. 1 : Nano self cleaning materials

**Objectives of nano-self cleaning**

Nano self-cleaning coatings have the objective of creating a surface that repels dirt, dust, and other contaminants, making it easier to clean and maintain. Nanotechnology, which involves the manipulation of matter on a nanoscale level, typically between 1 and 100 nanometers, is used to accomplish the goal of these coatings [6]. The coatings are intended to produce a surface with an exceptionally low surface energy that is extremely smooth and prevents dirt and other impurities from sticking to it. The diagrammatic approach is given in Fig. 2 [7].

- To make surfaces that are photocatalytic, hydrophilic, or hydrophobic for better results [8].
- To prevent the buildup of dust and debris [9].
- To stop surface-level biological growth [10].
- To stop surfaces from degrading by letting water run over them [11].
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**Diagrammatic approach**

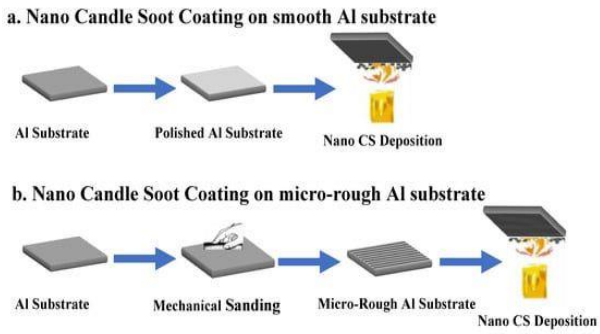


Fig. 2 : Concept of nano-self cleaning

**Applications of nano self cleaning**

The scope of these coatings is to offer an effective and practical solution to the issues of cleaning, corrosion, and wear in several industries, including the automotive, aerospace, marine, and construction.

- Automotive industry: Nano self-cleaning coatings are used in automotive paints, windshields, and headlights to improve visibility and reduce the need for cleaning [15].

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- Aerospace industry: These coatings are used in aircraft windows and surfaces to reduce drag and improve fuel efficiency [13].
- Marine industry: Nano self-cleaning coatings are used on ships' hulls to reduce friction and improve fuel efficiency.
- Construction industry: These coatings are used on building facades, roofs, and other exterior surfaces to prevent dirt buildup and reduce maintenance costs [14].

In general, the goal and scope of nano self-cleaning coatings are to provide surfaces that are simpler to clean, lower maintenance costs, and increase the effectiveness and reliability of goods and materials in various industries. The Fig. 3 gives the nano self cleaning with nano materials before & after the process [12].


Fig. 3 : Nano self cleaning with nano materials before & after the process

**Conclusions**

To sum up, self-cleaning superhydrophobic coatings were developed on engineering metal substrates through the use of paraffin wax surface coating and deposition of carbon soot nanoparticles. This approach resulted in the creation of coatings that exhibited excellent self-cleaning properties, effectively repelling both solid dust pollutants and liquid contaminants. These findings suggest a promising avenue for the development of durable and effective self-cleaning coatings for various engineering applications.

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