Seminar

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Institute for Plasma Research

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Title: Development of water-repellent coatings for cellulosic and metallic surfaces

Speaker: Dr. Poonam Chauan
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Date: 27th October 2023 (Friday)

Time: 03.30 PM

Venue: Seminar Hall, IPR

Abstract:

Textiles (cloth, jute) can be found everywhere around us. Every day, we use them for clothing, food packaging, hospital bandages, and various home and industrial applications. Similarly, metallic surfaces (aluminium, steel) are used in aerospace, marine, oil and gas industries, and automotive applications because of their suitable mechanical and physical properties, like low density, high mechanical strength, good electrical and thermal conductivity, and high ductility. The demand for protective coating on textiles and metal surfaces has been growing continuously due to different concerns according to the usage of substrates. Clothes are quickly stained by water-based products, which increases the number of laundry cycles and also promotes the spread of germs. In hospitals, items such as pillows, bed sheets, and patient gowns are often stained with blood, posing a serious risk of infection transmission. Thus, these limitations can be solved by fabricating superhydrophobic surfaces that are stain-resistant and antibacterial. Similarly, jute is mostly used for food packing (seeds). However, it can absorb moisture in a highly humid environment, causing a decrease in the span of life and quality of the enclosed seeds. Further, metals are susceptible to corrosion when exposed to a chlorinated or moist environment for a prolonged time, limiting their usage in multiple applications. Therefore, the work has been focused on developing the artificial superhydrophobic to avoid the above-mentioned issues. Superhydrophobic surfaces are characterized by a water contact angle (WCA) exceeding 150^{o} and a sliding angle less than 10^{o}. After modification, these constructed surfaces can be used in a broad range of potential applications such as water-repellency, anti-bacterial, anti-fungus, anti-viral, anti-stain, self-cleaning, oil-water separation, reducing water or moisture content, and anti-corrosion properties. This work was fascinating to produce superhydrophobic coatings that are durable, simple, transparent, environment-friendly, and cost-effective. In this case, simple fabrication techniques such as immersion, spray, chemical etching, and electrodeposition were used to create superhydrophobic coatings on the selected surfaces. There were no nanoparticles or fluorinated chemicals used in the fabrication of these coatings. Instead of harmful antimicrobial nanoparticles, green material (aloe vera extract) was used for inducing the antimicrobial and antiviral activities. In addition, a single silane compound was sufficient to achieve the desired coatings on selected surfaces without using any complicated instrument.