"We are probing materials at a deeper level, looking at how patterns arise in nature, and the inspiration for that comes from art, and we translate that question into the language of science, and we ask questions like — how do small-scale patterns form in nature and in technology?"

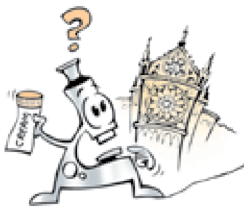
Ashutosh Sharma

Institute Chair Professor and C. V. Seshadri Chair Professor and Coordinator, DST Unit on Nanoscience & Center for Environmental Science and Engineering, Indian Institute of Technology, Kanpur

- B.Tech. in Chemical Engineering from the Indian Institute of Technology, Kanpur
- M.S. in Chemical Engineering from Pennsylvania State University
- Ph.D. in Chemical Engineering from State University of New York, Buffalo

Prof. Ashutosh Sharma has made scholarly scientific contributions in the broad areas of nanoscale surface pattern evolution, instability, and the dynamics of thin liquid and solid films and soft matter. These scientific studies have provided fundamental contributions to the fields of surfaces and interfaces, adhesion, structure evolution, nanocomposites, and hydrodynamics.

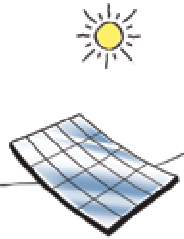
Nanotech chronicles



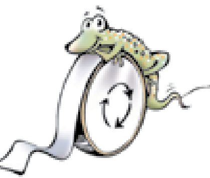
What do the Rose Window in the Notre Dame cathedral and anti-wrinkle creams have in common? Nanotechnology! Nano has been around for centuries but its understanding, manipulation, control and industrial applications have come of age in a big way only recently.

Today, nanotechnology is used in everything from consumer goods such as water-repellent clothing and cosmetics, computing, space exploration, the wider areas of health, environment and energy. Prof. Ashutosh Sharma's work in nanotechnology combines elements of engineering, surface chemistry and soft matter physics with a sprinkling of biology and biomimetics.

A major focus of Sharma's work has been in probing how and why nano-thin films and coatings of soft materials, such as polymers, become unstable and self-organize spontaneously into a variety of micro and nano-structures, patterns and textures. Controlling the self-assembly of these small structures leads to futuristic manufacturing techniques for creation of materials with special properties of wetting, adhesion, friction and color.



Sharma's research finds new interfaces between the disciplines of mechanics, materials and manufacturing with direct applications in inexpensive fabrication of nanostructures on large areas, flow of liquids in small spaces (micro and nano-fluidics used in the lab-on-a-chip devices), novel adhesives, and patterning for polymer based electronics and sensors including solar cells.



Working with other scientists, he created smart adhesive tapes that could be reused and was non-fouling. The sticky pads of climbing animals such as tree frogs and geckos were the inspiration in creating the special adhesive.

Another practical application of his work is in understanding some of the surface-chemical aspects of the dry eye syndrome which affects millions of people worldwide. A rapid breakup of the tear film on the cornea in the inter-blink period is often indicative of dry eyes. Sharma's research into wetting of bio-surfaces has led to some clues about the mechanism and control of the tear film breakup. Unlike most of the other studies, he used Interfacial Science for validating and testing his research instead of using animal models.

Sharma's nanofabrication work in collaboration with other scientists has also led to novel carbon based composite materials with hierarchical micro and nano elements that could have enormous benefits for the environment (filtration systems), energy storage (micro-batteries) and health (platforms for cells).