ME - Postdoc Work Presentations

Micro-scale Transport Phenomena: Crystallization & Boiling

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Meeting link: Click here to join meeting **(Microsoft Teams)**

ABSTRACT

Scale formation, due to the presence of dissolved salts, causes a reduction in the efficiency of heat transfer surfaces and leads to damage of historical monuments, buildings, and paintings. While there are several studies on the effect of octahedron crystals (NaCl) on scaling, understanding of scaling caused by acicular crystal (needle-type crystal) remains elusive. These needle-type crystals occur in nitrate salts which have several applications in day-to-day life such as, toothpaste, paints, fertilizers. Our experiments show the effect of needle-type crystals on substrates with different wettability (contact angle between 0 and 80 deg). During evaporation of a saline drop, we report the growth of needle-type crystals until the availability of bulk liquid around the crystals, whereas the nature of crystal deposit alters in the later stages of evaporation (in the absence of bulk liquid). In my talk, I will discuss a plausible mechanism for the wicking and crystallization phenomena.

I will also discuss about our studies on using an evaporation-based low-cost method to detect adulterants such as water and urea in milk. The evaporative deposition in milk is observed to be strongly dependent on the presence of added urea and water. While an amoeba-shaped deposition is observed upon evaporation of a droplet of undiluted milk, it disappears with the dilution. Similarly, urea in milk can be detected by imaging the evaporative pattern of the adulterated milk. The detection level of urea is improved with the dilution of milk. This method provides a low-cost platform for the detection of milk adulterants and can be used even at remote locations in the absence of sophisticated adulterant detection devices.

ABOUT THE SPEAKER

Dr. Virkeshwar Kumar received his bachelor's degree from National Institute of Foundry and Forge Technology, Ranchi in 2014, followed by Ph.D. degree from the Indian Institute of Technology, Bombay in Mechanical Engineering in May 2020. His doctoral work focused on the evolution of natural convection during the solidification of multi-component alloys. Dr. Kumar joined Indian Institute of Science in July 2020, as a C.V. Raman Postdoctoral Fellow, working with Prof. Susmita Dash in the Department of Mechanical Engineering. His current research focuses on evaporation-based experiments such as crystallization, detection of adulterants in milk, and boiling.