

# Technical Meeting on Emerging Applications of Plasma Science and Technology

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## Plasma diffusion treatments and coatings for industrial applications

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Modifying the surface properties is often a necessary part of the industrial process as most of the components manufactured by common material processing methods have limited abilities when operated for specific applications. These applications require improvement in surface properties like wear resistance, corrosion resistance, biocompatibility, etc.

Surface modification by plasma is extremely versatile and used in a range of industries. Plasma processing is frequently used for surface modification without sacrificing the bulk properties for more than a few decades due to its numerous advantages, as it provides good adhesion and high homogeneity, can be easily tailored, and for less power and consumable consumption than compared to the conventional process. Institute for Plasma Research (IPR) has developed several low and sub-atmospheric pressure plasmas for modifying the surfaces to improve their functional properties [1-3]. Such coatings enhance wear and corrosion resistance properties or improve biocompatibility, all from a value-driven and green alternative to harsh chemical techniques point of perspective.

The present talk elaborates on the different plasma-based diffusion processes like plasma nitriding along with their variant processes, plasma-assisted physical vapor deposition (PVD), to name a few which are beneficial to society at large. Diffusion-based coatings have been found to be an alternative technique to enhance the corrosion resistance of metallic materials, thus expanding the life span of the metal components pertaining to different industrial applications. Protective coatings by PVD on implants and yarn have also been found to significantly improve biocompatibility and antibacterial properties.

Hence, plasma engineering of surfaces has several unique features allowing modification of the sub-surfaces of a variety of materials. The plasma-based methods of surface engineering provide cost-effective, environmentally friendly, and scalable solutions for both research and industry with an enormous potential still to be fully explored.

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