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Recent Advances in Surface Engineering

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Surface Engineering (SE) is the science and technology of improving the surface properties of materials for protection in demanding contact conditions and aggressive environments. SE also encompasses engineering new multi-functional surface properties, such as electrical, optical, thermal, chemical, and biochemical properties. It involves multiple or hybrid processes which include substrate modification and deposition of overlayers in complex architectures. These processes enhance adhesion and optimize composition or microstructure to enhance protective properties coupled with other functionality. The substrates may be of complex shapes, like metal-cutting tools and automotive or aerospace components, and range in size from micrometers, such as in MEMS or NEMS (micro- or nano-electromechanical systems) devices, to meters, such as in architectural glass. The applications are wide-ranging, and include, for example, control of friction, wear-resistance, corrosion-resistance, thermal-barrier coatings, decorative coatings, bioimplants, antimicrobial layers, web-coatings, and thin films with engineered electrical and optical responses. Areas of scientific interest range from first-principle atomistic studies of new materials, which are both hard and ductile, (i.e., tough), to scientific and technological advances in synthesis methods, structural and chemical characterization techniques, property measurements, and performance characterization of surface-engineered parts. I will highlight a few selected SE advances from the past three years.

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