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Frontiers of Surface Science. Structure, Bonding and Dynamics on the Nanoscale at High Pressures and at the Buried (solid-liquid and solid-solid) Interfaces

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Model surfaces from single crystals to monodispersed nanoparticles are investigated at high pressures and at liquid interfaces by sum frequency generation (SFG) vibrational spectroscopy and high pressure scanning tunneling microscopy. The phenomena discovered by surface studies at low pressures in the past, adsorbate-induced restructuring, the chemical activity of surface defects, surface mobility of adsorbates and coadsorption-induced ordering are detected at high pressures as well. Newly discovered surface phenomena include the low melting point of nanoparticles, the coadsorption of water and hydrogen at polymer and metal surfaces, respectively, and hot electron flow during exothermic processes across oxide-metal interfaces (nanodiodes). Applications of surface science expanded into nanosciences, catalysis, tribology, polymers, biointerfaces, microelectronics, energy conversion and environmental chemistry will be discussed.