

## Crimson Japan

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Electroless nickel-phosphorus ( Ni-P ) coatings are widely used in many industrial applications due to their excellent wear , corrosion , hardness , toughness , and lubricity properties . By combining nano-sized particles in the Ni-P matrix as a reinforcing phase , functional nano-composite coatings are produced by electroless ~~co-deposition~~eutectoid process . The composite properties of Ni-P coatings are greatly improved and some new functions are added . Nanoparticles such as SiC , WC , Al<sub>2</sub>O<sub>3</sub> , TiO<sub>2</sub> , and ZnO increase the hardness of the coating , while nanoparticles such as PTFE ( TM Teflon ) , MOS<sub>2</sub> , and graphite increase the lubricity . Among these nanoparticles , PTFE has low surface energy and friction coefficient ( good as non-adhesive surface and dry lubrication ) , and has attracted increasing interest due to its ~~high~~antifouling properties , wear resistance , and corrosion resistance . Ni-P-PTFE can be used as an anti-adhesive coating . Fluorine atoms bonded to the outer layers of these molecules have major physical properties such as low surface energy and very low friction coefficient of PTFE polymers . Both Ni-P and PTFE properties can be used simultaneously by ~~co-precipitating~~eutecticizing PTFE in the coating matrix . PTFE polymers have excellent antifouling properties due to their low surface energy ( 18.6 mN/m ) . The use of Ni-P-PTFE composites for contamination reduction is expected as a solution to the serious problem of the formation of deposits such as lime on the heat exchanger surface . This sediment is one of the essential problems in the design and operation of many production facilities and processing equipment . This undesirable sediment may have two kinds of effects on the equipment .

- The thermal conductivity of the deposited material is low and the heat transfer resistance is high , which reduces the efficiency of the heat exchanger .
- When deposited on piping , the cross-sectional area of the fluid passage decreases and friction increases , causing pressure ~~drop~~loss throughout the system .

Such accumulation of sediment can be reduced and costs can be reduced . The surface with low surface energy was found to have less deposition , and many polymer coatings have been used . Conventional polymer coating agents have limited industrial applications because of their low thermal conductivity , wear resistance , and poor adhesion to the substrate . Since Ni-P-PTFE coatings are based on metal composites , their thermal conductivity , mechanical strength , and wear resistance are much better than those of conventional PTFE coatings , and their surface energy is also low .

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