

Nanocontainer-Based Multifunctional Self-Healing Coatings

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The application of nanocontainers of different types (polymer capsules, mesoporous silica nanoparticles with pH-sensitive stoppers, halloysite nanotubes) is demonstrated for self-healing water-based and powder coatings with additional antifouling effects. The nanocontainers are loaded with highly effective inhibitors for healing functionality or biocides for antifouling functionality. The autonomous release of the encapsulated inhibitor or biocide was performed by three possible triggers: mechanic impact, changes of the local pH in the corroded and (or) fouled area and external electromagnetic irradiation. The multifunctional performance of the nanocontainer-doped coatings was demonstrated employing several commercially available paint formulations as coating matrices for hosting nanocontainers with the use of both laboratory-scale tests (electrochemical impedance, SVET) and industrial-scale tests (neutral salt spray tests, weathering tests). Besides the incorporation of the single nanocontainer-cargo combination into the coating host, the efficiency of the use of nanocontainer mixtures was demonstrated, especially for different types of the active cargo. Up-scaling possibility for nanocontainers was demonstrated by CDDM technology achieving 20-50 kg/hour production.