



Nanocomposite — From Improved Properties to Fundamental Understanding

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Nanocomposites have been widely studied for their dramatically improved properties, such as mechanical strength, thermoelectric performance, chemical reactivity, and optical properties. With new materials and nanomanufacturing techniques, new opportunities are further introduced to this long-running research direction. This issues have multiple interesting papers dedicated to this important topic.

For mechanical properties, Hu *et al.* (DOI: 10.30919/esmm5f158) demonstrated the use of hydroxide (Ca(OH)₂) nano-spherulites (CNS) with <5 nm diameters as cross-linkers to achieve highly stretchable self-healing nanocomposite hydrogel. For solid lubricant applications, Joseph *et al.* (DOI: 10.30919/esmm5f152) added MoS₂ nanosheets to plated Ni coatings to dramatically improve the microhardness and wear resistance of the obtained Ni-MoS₂ composite.

Improvements can also be found on the chemistry side. By coating ultrathin MoSe₂ nanosheets onto hollow carbon spheres (HCS), Yuan *et al.* (DOI: 10.30919/esmm5f112) reported remarkable hydrogen evolution reaction activity, which was attributed to more active edges and the beneficial conductivity provided by the HCS core. Guo *et al.* (DOI: 10.30919/esmm5f168) reported TiO₂/β-cyclodextrin organic-inorganic hybrid nano-material with outstanding photocatalytic activity and recyclability on photocatalytic water splitting. In addition, Wei *et al.* (DOI: 10.30919/esmm5f162) showed cross-linked porous corn starch with high methyl violet adsorption capability. As a review, Wang

et al. (DOI: 10.30919/esmm5f175) discussed the current status of nanocomposite adsorbents to remove heavy metal from wastewater.

In addition to the property improvement, “side effects” of some nanostructure additives should also be addressed. For example, Ghahari (DOI: 10.30919/esmm5f172) studied the elongated induction period time and delayed hydration process for cement pastes due to added ZnO-based nanoparticles.

On the fundamental side, Magnone *et al.* (DOI: 10.30919/esmm5f176) proposed some explanations for the point of discontinuity on the Arrhenius relationship for the Ba_{0.5}Sr_{0.5}Co_{1-x}Fe_xO_{3-δ} solid solution. In their argument, the commonly used Arrhenius law with a single activation energy is not applicable to such complicated solid solutions involving multiple chemical/physical processes. Based on simulations, Zhao *et al.* (DOI: 10.30919/esmm5f135) showed that the growth of Ni-Cu alloy dendrite was affected by the interface thickness. This can provide important guidance for such structure growth.

In summary, there exists many practical and fundamental problems for the future studies of nanocomposite and generally nanostructured materials. A better understanding of these problem can pave the way for the advancement of many mechanical- and chemical-related applications. We anticipate to see more papers in coming issues and welcome new efforts for other directions, such as thermal and optical properties of nanostructured materials and their large-scale manufacturing processes.

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