

Editorial: State of the Art of Colloid and Interface Science in Asia

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This Special Issue brings together a diverse collection of contributions that highlight the rapid advances and emerging directions in colloid and interface science across Asia. This Special Issue comprises one mini-review and ten original research articles, reflecting the breadth of topics and the interdisciplinary nature of the field.

Colloid and interface science continues to expand its influence across energy, materials, biology, medicine, and food systems. Yet, despite remarkable progress, several gaps remain in our understanding. For example, while novel colloidal structures and functional interfaces are being developed, challenges persist in scaling fabrication methods, ensuring long-term stability, and translating laboratory findings into industrial applications. Similarly, while nanostructured materials and advanced emulsions show promise in biomedical and agricultural contexts, questions of safety, reproducibility, and environmental impact remain critical.

In the mini-review on Janus hydrogels for battery applications, Li and Wang [1] illustrate how asymmetric architectures can overcome the inherent limitations of conventional hydrogels, enabling improved ion transport and effective dendrite suppression. This work fills a critical gap in energy storage research by reframing hydrogel design through the lens of interface engineering.

The original articles span diverse applications. In the field of **nanoparticle fabrication and stabilization**, Assan et al. [2] employed a microchip laser-based pulsed ablation technique to directly generate small gold nanoparticles (~4 nm) within sensitive biopolymer matrices such as gelatin and collagen, preserving structural integrity while mitigating aggregation. Complementarily, Lei et al. [3] advanced short-wave infrared photodetectors by applying an interface engineering strategy with 3-aminopropyltriethoxysilane (APTES), which improved quantum dot–electrode contact, enhanced responsivity, controlled dark current, and accelerated photo-response.

Surface modification and characterization emerge as central themes across four studies. Huang et al. [4] demonstrated that liquid-phase plasma electrolysis (LPE) effectively removed sizing agents from carbon fiber surfaces, with SEM, TGA, and XPS confirming near-complete removal while maintaining fiber activity. In mineral processing, Xing et al. [5] showed that a blended xanthate collector (W8) with ammonium dibutyl dithiophosphate (ADD) improved gold recovery from refractory arsenopyrite ore, supported by AFM, contact angle, and adsorption density analyses. Noskov et al. [6] revealed that mixed adsorption layers of oat globulin amyloid fibrils and sodium polystyrene sulfonate formed threadlike aggregates and multilayers at liquid–gas interfaces, explaining enhanced foam stability. Shah et al. [7] systematically investigated CTAB and AOT surfactants in ethylene glycol–water mixtures, finding reduced hydrophobic interactions, looser interfacial packing, and surfactant-specific adsorption behavior, with surface tension and



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adhesion measurements confirming improved wettability. Collectively, these works underscore the pivotal role of surface modification and detailed characterization in optimizing material performance, flotation efficiency, interfacial stability, and wettability.

In **sensing and detection**, Meng et al. [8] reported a scalable, eco-friendly strategy for fabricating hybrid surface-enhanced Raman scattering (SERS) substrates by integrating Au nanoparticles with WO₃ nanowires via green photoreduction. The resulting Au/WO₃ nanocomposite achieved highly sensitive detection of Rhodamine 6G down to 10^{−11} M and enabled effective detection of weakly adsorbing molecules such as DMMP. In **catalysis**, Wang et al. [9] developed atomically dispersed bimetallic Pt–Sn nanocluster catalysts supported on TiO₂ to enhance hydrogenation in the toluene–methylcyclohexane cycle, a model liquid organic hydrogen carrier system. Mechanistic studies revealed that Sn incorporation modulates Pt's electronic structure, improving H₂ activation and spillover, thereby advancing liquid organic hydrogen carriers (LOHCs)-based hydrogen storage technologies.

In **biological systems and related applications**, Qiao et al. [10] highlighted silk fibroin (SF), a natural amphiphilic protein, as a versatile stabilizer of emulsions for cosmetics, food, drug delivery, and biomedicine. Nanostructured SF forms provided superior stability under harsh conditions due to strong interfacial networks. In parallel, Asmawi et al. [11] developed an eco-friendly hexaconazole-loaded nanoemulsion (Hexa-NE) to combat fungal pathogens in palm oil crops, demonstrating excellent physicochemical stability, sustained fungicide release, and highly effective antifungal activity against *Ganoderma boninense*.

Together, these contributions advance fundamental understanding while offering practical pathways for applying colloid and interface science to societal challenges. They address knowledge gaps in stability, scalability, and application-specific performance, while opening new opportunities for interdisciplinary collaboration. Looking forward, future research will likely emphasize the intelligent design of multifunctional colloidal systems that integrate sustainability, biocompatibility, and scalability; translational studies bridging laboratory innovation with industrial and environmental applications; and exploration of colloid science in emerging fields such as flexible electronics, biointegrated energy systems, and precision agriculture. This Special Issue underscores the vitality of colloid and interface science in Asia and beyond, inspiring further research, fostering collaboration, and stimulating industrial translation of colloid-based technologies.

Conflicts of Interest: The authors declare no conflicts of interest.

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