Improved Manufacturing Processes for Better Materials Properties—From Quantum Dots to Bulk Materials

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For many applications, the performance of materials has been continuously improved with modified manufacturing processes and materials engineering. This issue collects several interesting papers along this critical research direction. These studies range from zero-dimension (0D) quantum dots to three-dimension (3D) bulk composites (Fig. 1).

Four papers are focused on the materials engineering by composition optimization. Different synthesis techniques are employed in these papers. For provskite quantum dots synthesized via the auxiliary ligand precipitation, Liu *et al.*^[1] replaced the toxic Pb^{2+} in MAPbBr_3 ($\text{MA} = \text{CH}_3\text{NH}_3^+$) with non-toxic Cu^{2+} to achieve a high stability and a low toxicity. The fluorescence emission intensity of these quantum dots was gradually decreased with an increased concentration of Cu^{2+} , and the phenomenon of blue shift appeared. For microfibers synthesized by chemical route under the oxidative polymerization, Ingle *et al.*^[2] doped polyaniline with protonic acids such as HCl and H_2SO_4 . The redshifts were observed for the doped microfibers. For metal organic chemical vapor deposition (MOCVD) growth under different conditions, the optical properties of Ni-doped ZnO

thin films on sapphire were investigated by Manzoor *et al.*^[3] Different X-ray diffraction peak intensity and optical absorption spectra were observed for samples using different growth conditions, with the same Ni flow rate injection to the reaction chamber.

Other than modifying the composition of specific materials, the properties of a given material can always be largely improved by its composites with other materials. For example, Das *et al.*^[4] investigated the flame retardancy of vinyl ester resins (VER) reinforced with nanotitania (nano- TiO_2) nanofillers. Further improvement was found with the surface functionality of nano- TiO_2 by adding Si and N_2 to improve its flame retardancy. Liang *et al.*^[5] studied the compatibility between fluorine-acrylic emulsion and sulphoaluminate cement for potential applications of their composites. In their study, sorbitol was identified as the best retarder to improve the compatibility between the two constituent materials, which was evaluated with the cement paste fluidity, rheological property, tensile strength, and water absorption. Beyond new synthesis techniques, there is still plenty of room to improve some well-established

Fig. 1 Materials with different dimensions: a) 0D quantum dots; b) 1D wires or fibers; c) 2D thin films or membranes; and d) 3D bulk composites.

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techniques, such as injection molding technology with a history for almost 150 years. Fu *et al.*^[6] gave a comprehensive review on this important technique that is used to produce roughly one third of all polymer products and further many composite materials.

In summary, the advancement of materials engineering and manufacturing techniques has enabled many intriguing products with high performances, environmental friendliness, and low costs. Examples can be found in various cases, ranging from low-dimensional materials (e.g., quantum dots and microfibers) to bulk nanocomposites. More important papers are anticipated for incoming issues for this vibrant research field that can have profound impact on our everyday lives.

References

- [1] B. Liu, M. Ji, J. Li, P. Hou, Y. Lu, Q. Li, B. Cao and Z. Liu, *ES Mater. Manuf.*, 2020, doi: 10.30919/esmm5f795.
- [2] R. V. Ingle, S. F. Shaikh, P. K. Bhujbal, H. M. Pathan, V. A. Tabhane, *ES Mater. Manuf.*, 2020, doi: 10.30919/esmm5f732.
- [3] Z. Manzoor, V. Saravade, A. M. Corda, I. Ferguson and N. Lu, *ES Mater. Manuf.*, 2020, doi: 10.30919/esmm5f715.
- [4] R. Das, S. Vupputuri, Q. Hu, Y. Chen, H. Colorado, Z. Guo and Z. Wang, *ES Mater. Manuf.*, 2020, doi: 10.30919/esmm5f709.
- [5] C. Liang, P. Zhao, P. Hou, S. Wang, V. Strokova, L. Lu and X. Cheng, *ES Mater. Manuf.*, doi: 10.30919/esmm5f707.
- [6] H. Fu, H. Xu, Y. Liu, Z. Yang, S. Kormakov, D. Wu and J. Sun, *ES Mater. Manuf.*, doi:10.30919/esmm5f713.

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