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Towards high strength nanocomposite magnets — Approaches from the bottom¹

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Exchange-coupled nanocomposite magnets are regarded as the next generation of permanent magnetic materials, based on the theoretical predictions. However, many fundamental questions and technical challenges remain in understanding the inter-phase exchange interactions and in processing bulk nanocomposite magnets with enhanced energy products. We will review recent advancements in both the fundamental research and the materials processing technologies. New findings about the effects of soft-phase properties and interface conditions on the hard/soft phase exchange interactions will be presented. Particularly, the development of the bottom-up approaches in materials processing will be discussed. Novel methodology for nanoparticle synthesis including the salt-matrix annealing, surfactant-assisted ball milling and severe plastic deformation will be described. Unconventional compaction techniques including warm compaction and dynamic compaction are recommended because they can be used to retain desired nanoscale morphology for effective exchange coupling in bulk nanocomposite magnets. A perspective on fabrication of anisotropic nanocomposite magnets will be also given.

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