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Sommario/riassunto	The reprint has collected the latest scientific achievements in the microstructure-related deformation and fracture behavior of various metallic materials (e.g., steels, superalloys, and titanium alloys) under monotonical or cyclic loads. According to the research findings arising from this collection of works, the initial microstructure and microstructural evolution have a significant effect on deformation and fracture mechanisms and, thus, mechanical properties. To understand these influences, microstructure characterization, mechanical property testing, and numerical simulation are discussed in this reprint. These results are beneficial for promoting the potential applications of these materials and for the future development of novel high-performance metallic materials.