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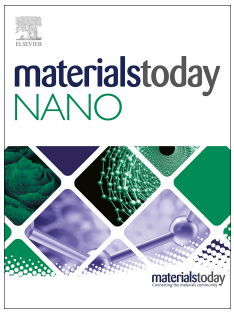

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Novel Behaviors/Properties of Nanometals Induced by Surface Effects

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Abstract

Surface effect is believed as one of the most important origins from which the novel properties of nanomaterials derive. Although this effect has been investigated for decades, the understanding of the essential correlations between materials' structures and their unique properties still has a long way to go. Recently, the innovation of aberration-correction techniques in electron microscopy, as well as the fast-developing *in situ* techniques, has made a big step toward unveiling the mysterious mechanisms underlying the unusual behaviors. In this review, we summarize the surface effect-induced extraordinary phenomena of nanometals that were uncovered recently, including peculiar mechanical behaviors, unusual thermal instabilities, remarkable electromigrations, unconventional structure evolution, and phase separations. All these findings apparently give an in-depth understanding of the novelties that appeared only in nanometals, such as the rubber-like or liquid-like deformation behaviors in mechanics, the size-dependent melting and wetting behaviors in thermodynamics and surface science, the atomic-scale welding and mass conveying in electrics, and the size- or composition-dependent phase segregations in kinetics and metallography. Such abundant knowledge not only extends the classical theories established on bulk materials but also can provide valuable instructions for future applications of nanometals such as the design of