Designing eco-friendly interface-dominated alloys guided by In-situ experiments & simulations

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Advances in heterophase materials with high interface density have been the key in the immense technological progress surrounding us, from bone implants to efficient power plants to lighter cars. The climate change, however, necessitates game-changing materials solutions to sustain this progress. To this end, an integrated experimental-simulation methodology is developed that enables high resolution mapping of deforming microstructures, and associated complex micro-strain and micro-stress fields. This approach involves coupled use of various microscopic imaging techniques, image post-processing tools and crystal plasticity simulations. These maps pave the way for developing quantitative guidelines to design various superior-performance, eco-friendly alloys, e.g. Ti-Nb alloys, dual phase steels, TRIP-maraging steels, etc.