

Recent development of metallic nanocomposites for structural applications

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We summarize our recent works on the advanced metallic nanocomposites with exceptional dual mechanical properties using multiscale metallurgical structure-driven design combined with advanced mechanical simulation. The effect of nanostructured materials on the mechanical behavior and the failure mechanism of metallic material show the possibility to develop different new nanomaterials with extraordinary mechanical properties. The computational models and experimental results successfully provide valuable information about the multiscale nanomaterials properties as a function nanostructured multiphases configuration. The processing of nanomaterials using mechanical processing and heat treatment has been studied at nanoscale and atomic scale. The material studies using nanomechanics based experimental investigations (nanoindentation and nano-pillar tests) can reveal the effects of the atomic structure and nanostructure gradient on the mechanical behaviors. The failure mechanisms study at atomic, nano-, micro- and macroscopic scale can provide efficient ways to enhance the ductility of materials using the general approach of strain non localization. We shall specially introduce the progress on the development of the high strength and high ductility industrial alloys with multilayered nanomaterials, high density nano twinned stainless steels, hierarchical nanotwinned TWIP steels and new Mg based nanostructured composite. The potential applications in lightweight car, bio-implant, energy and aerospace sectors will be presented. The integration of nanomaterials using advanced design tools with associated processing development will be introduced.

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Short Biography

Prof. Jian LU is Chair Professor of Mechanical Engineering; Vice President (R&T) at the City University of Hong Kong. He obtained the Dip. Ing., and Doctoral degree from University of Technology of Compiegne in 1984 and 1986 respectively. From 1986 to 1994, he was appointed as Senior Research Engineer at the CETIM. In 1994, he was appointed as Professor; Head of Department of Mechanical Systems Engineering and Director of Mechanical Systems and Concurrent Engineering Laboratory jointly supported by French Ministry of Education and CNRS) at University of Technology of Troyes, France. From 2005 to 2010, he was Chair Professor and Head of Department of Mechanical Engineering at the Hong Kong Polytechnic University. He has published more than 350 SCI journal papers (Science, Nature Materials, Materials Today, Advanced Materials, Nature Communications, PRL, JMPS, Acta Mat.). He was elected as an Academician of the National Academy of Technologies of France in 2011.