Serration and Noise Behavior in Advanced Materials

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The Chinese Materials Research Society (C-MRS) Conference (2015) was held in the Guizhou Park Hotel International Conference Center, Guiyang, China, from July 10 – 14, 2015. This conference consists of 30 symposia, including 4 international symposia. As one of 4 international symposia, “Serration and noise behavior in advanced materials” (i.e., CC symposium) was well organized to provide an effective platform for the scientists focusing on the intermittent phenomena in materials science.

As we know, serration and noise behaviors exist everywhere in our daily life, such as the crackling noise arising from paper crumpling, and fault movement during earthquakes, etc. In materials science, the phenomenon of serration and noise is also ubiquitous, particularly, in the deformation behavior of materials, which usually manifests as serrated plastic flows. Over the past few years, this interesting and universal phenomenon has attracted tremendous research interest, which can be observed among a wide range of advanced materials including granular matters, single-crystal metals, ice, rocks, AlMg alloys, Ti-based alloys, low carbon steel, transformation induced plasticity (TRIP) steels and twinning induced plasticity (TWIP) steels, shape-memory alloys (SMAs), high-entropy alloys, and metallic glasses, etc. To deeply understand the physical picture of the universal noise behavior, different elastic coupling models have been proposed, with a variety of scaling relations. However, the source of noise

when these advanced materials are deformed is still being debated. One possible reason is the serration behaviors maybe related to the structural flow units in materials, e.g., dislocations, twinning, stacking faults, adiabatic shear bands, grain boundary, and vacancy in crystalline materials, free volume, liquid-like region, shear-transition zone (STZ), tension-transition zone (TTZ), β relaxations, soft regions or soft spots in amorphous materials. Another possible reason is the stress waves or the noise coming from the surrounding environments. In the community of materials, understanding the structural origin of the noise may help avoid the catastrophic failure of materials, and therefore, provide the useful information to conduct the design of advanced materials approaching a high strength with a minor trade-off plasticity. In this special issue, we intend to provide comprehensive study related to the serration and noise behavior of various advanced materials. Topics include but are not limited to theoretical modeling, experimental characterization, and numerical simulations.

Key words

- (1) Plastic deformation and serration behavior
- (2) High entropy and amorphous alloys
- (3) Structural flow units for plastic deformation
- (4) Deformation behaviour in AlMg alloys
- (5) Twinning Behavior in titanium alloy