

Application of advanced characterization techniques in severe plastic deformation (SPD) research

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Abstract.

Advanced characterization techniques underpin critical microstructural and microanalytical phenomenon in the severe plastic deformation (SPD) research. SPD stands for a range of techniques that induce very high deformations in malleable metals/alloys to refine the substructure into the nanoscale regime inside of a bulk metal block. SPD techniques develop various exotic properties in materials that are otherwise known ordinary. This presentation shows applications of Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and Atom Probe Tomography (ATP) based techniques for evaluating microstructures and crystallographic textures in two- and three- dimensions. SPD was conducted by using the so-called accumulative roll bonding (ARB) technique that involves bonding of two metal sheets via high deformations. A continuation of the bonding process incorporates very high plastic strains in the processed sheets. ARB can fabricate both monolithic and hybrid structures via choosing same or different candidate materials. This presentation will demonstrate the evolution of a wide variety of ARB processed layered hybrid nanostructures. Some critical conclusions that were made with the aid of nano characterizations will be presented in great detail.