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TMS 2020

149th Annual Meeting & Exhibition

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Characterization

Material Behavior Characterization via Multi-Directional Deformation of Sheet Metal

Engineering sheet metals are customarily characterized by simple mechanical tests in order to meet mechanical properties given in OEM specifications. A set of uniaxial tension tests suffice to provide various standardized properties. However, when OEMs stamp a blank sheet to shape their final products, the materials experience quite complicated histories of straining paths that may significantly differ from behavior that is characterized by conventional mechanical tests. The advanced constitutive models of today require material parameters obtained under multiaxial and complex loading conditions. Over the past decades, the sheet metal forming community has observed that such advanced constitutive models improve the predictive accuracy on formability and springback. However, in order to successfully train the models, unconventional experimental methods are often required. Here a list of notable experimental methods is given: 1) the cruciform test was designed to strain sheet metals in various stress ratios; 2) The tension-compression test was designed to provide a deformation history representing the bending and unbending of sheets during stamping; 3) The hydraulic bulge test is a widely spread method to obtain hardening curves to large levels of plastic strain, which standard uniaxial tests cannot provide; 4) Combination of non-coaxial loadings can provide various stress states, to which the phase transition is sensitive; 5) An experimental setup consisting of multiple steps with various pre-strainings is also practiced in order to observe constitutive behaviors under complex histories of deformation that may occur in typical industrial stamping processes; 6) High speed tests can subject the materials to a rate of speed similar to what is actually observed during the stamping process.

The objective of this symposium is to explore numerous advances in experimental testing and computational methods used for material characterization, constitutive modeling, and analyses pertaining to sheet metal deformation in multiple directions along multiple axes or with changing strain path conditions. Abstracts are encouraged on research of material behavior related to microstructure based on multiple directional deformation including but not limited to:

- Improvements and new methods of mechanical property measurement
- Characterization of phase transformations and deformation mechanisms in multiphase microstructures during forming
- Theory and modeling related to the mechanical properties
- Deformation simulations, forming processes, friction and springback
- Multi-directional mechanical testing and advanced strain/stress measurements
- Integration of scientific knowledge with manufacturing practices
- Development of accurate constitutive relationships

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Abstract Deadline is July 1, 2019. Submit online at
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Questions?
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