

Examination Crystal plasticity in Cool draw tube forming using FEM and Voronoi Tessellation

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The analyses of the tube drawing process can be divided into two basic parts of investigations. Macro-scale and Micro-scale. Macro-scale analyses involve investigation of dimensional accuracy of the formed specimen, drawing forces, strain, stress, etc. The analyses of the tube drawing process in the macro-scale have been studied experimentally or theoretically using numerical methods for many years. For the final product of drawing process is also important to know the surface quality for example. For this purpose, it is important to know micro-scale material properties (spatial distribution of grain neighborhood orientation etc.), and examine the context of micro forming material.

There has been a trend in the last decade to make a link between macro-scale forming and micro-scale material properties and name it Multi-scale modeling. This research illustrates the possibility to use Voronoi Tessellation grain microstructure model in Deform FEM software to predict grain plasticity. The result obtained from numerical simulation is compared with direct reconstruction, derivation of basic stereology equation, and measurement using the line coincidence method of the oriented line using real specimen grain deformed in the cold forming process drawing the tube through a die.

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