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Aluminum Alloy Stamping with a First Warm Step and a Second Cold Step

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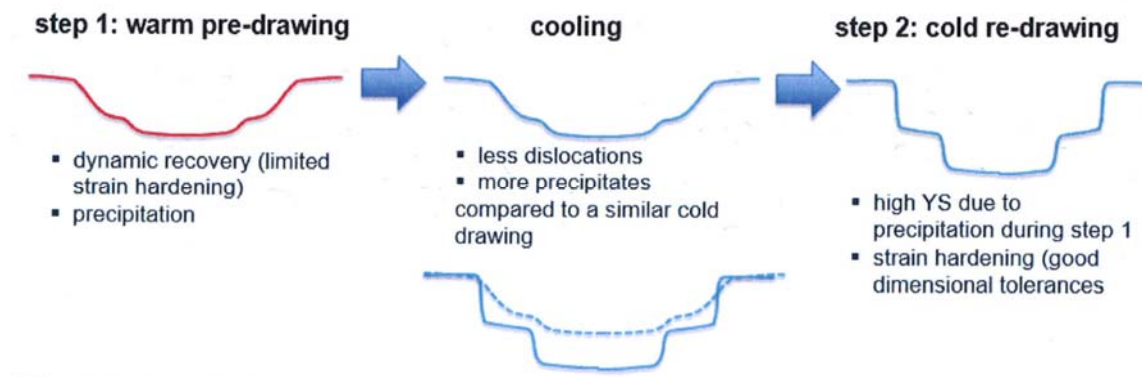
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Aluminum Alloy Stamping with a First Warm Step and a Second Cold Step

This paper describes a way to simultaneously improve the formability and final strength of 6xxx aluminum alloys by doing a two-step stamping process, namely a warm forming step followed by a cold forming step.

The first warm forming step will allow for a higher total draw depth (after the 2 steps) thanks to dynamic recovery during this warm forming step. By heating to the warm forming temperature (200-300 °C), will allow for some precipitation hardening. After cooling, the material will thus, contain fewer dislocations and more precipitates compared to a similar cold forming.

The second forming step is conducted at room temperature and gives a high yield strength due to work hardening and precipitation that occurred during the first step. This cold forming step can give standard dimensional tolerances (no thermal expansion to account for).



With this control of precipitation, this process allows for an improved formability and a high final strength, with no post-form heat treatment needed. This also can give rise to higher strength with a low temperature paint bake cycle.

This process was tested on AA6014. The warm forming test was simulated by warm pre-straining in a tensile machine and a tensile specimen was then machined in the strip and cold tensiled to simulate room temperature forming. This resulted in an improved elongation with 20% prestrain at 250 °C with a total elongation of 32.5% compared to 26.2% for a one-step room temperature tensile strain. This also gave a higher Rp0.2 after 20% prestrain at 250 °C of 250 MPa.