A High Strength Aluminum Alloy for Automobile Suspension Forgings

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The A6061 aluminum alloy has been used typically for the forged suspension parts for automobiles. In response to the requirement for reducing automobile weight, we developed a high-strength 6000 series aluminum alloy (KS651) having excess Si to reduce the weight of forged aluminum suspension parts. To further respond to ever growing needs for automobile weight reduction, we developed forged suspension parts using an aluminum alloy having even higher strength (KS610) (**Photo 1**). The following describes properties of KD610 alloy and the forged automobile suspension parts made of the alloy.

Properties

1) Tensile and proof strengths are both higher by 40% than 6061 alloy and by 10% than K651 alloy (**Figure 1**).
2) The automobile suspension made of the alloy is lighter by 15% than the one made of 6061 alloy and by 5% than the one made of KS651 alloy.

The above characteristics are achieved by the modification of the microstructure of KD610 alloy. The modification was accomplished mainly by the optimization of the forging process, involving a hot forging at a temperature 100 ℃ higher than conventional forging temperature to produce a recovery structure and a T6 heat-treatment to increase the area ratio of subgrains (**Photo 2** and **Photo 3**).

Details on subgrains

The temperature of the material to be forged is about 400℃ in conventional hot aluminum forging. In order to prevent the work strain, the coefficient Z of the Zener-Hollomon's formula was maintained as low as possible,

where; $Z = A \cdot \dot{\varepsilon} \cdot \exp\ (Q/RT)$ ·····(1)

A: material constant, $\dot{\varepsilon}$: strain rate, Q: activation energy, R: gas constant and T: absolute temperature.

The strain rate $\dot{\varepsilon}$ was determined by the forging press used and the material temperature was raised to lower the value of Z (**Figure 2**, **Figure 3**).

Photo 1 Exemplary forgings of KD610

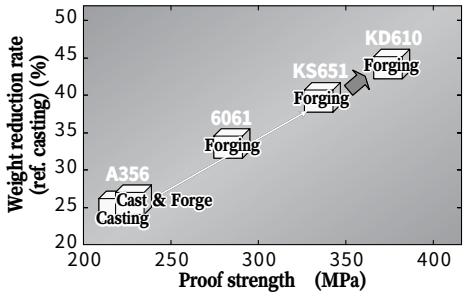

Fig. 1 Relation between weight reduction effect and material proof strength

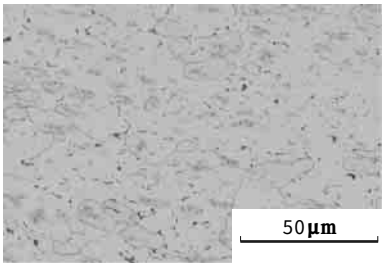

Photo 2 Microstructure of a sample forged at a low temperature

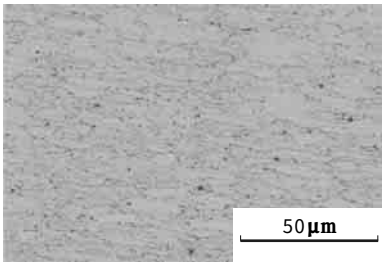

Photo 3 Microstructure of a sample forged at a high temperature

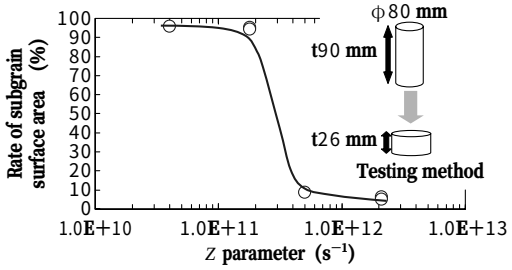

Fig. 2 Relation between subgrain area and Z parameter

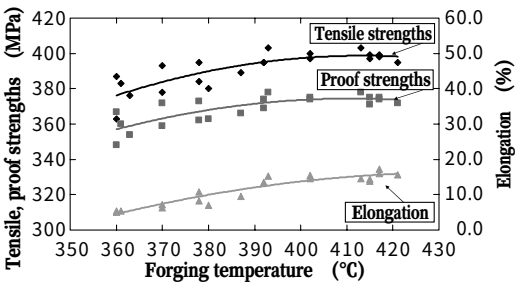

Fig. 3 Mechanical properties of materials forged at various temperature