

## Upsizing of Severe Plastic Deformation Process under High Pressure

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Significant grain refinement is achieved using a process of severe plastic deformation (SPD) [1]. When the SPD process is conducted under high pressure as high-pressure torsion (HPT) [2] and high-pressure sliding (HPS) [3], the applicability of the SPD process is further extended to hard and brittle materials. However, an important issue is how the HPT and HPS processes can be scaled up. This presentation introduces our recent challenges for scaling up both HPT and HPS processes to the capacity of 500 ton.

For the HPT process, disks of an AZ61 Mg alloy with 30mm diameter and 1mm thickness were processed under a pressure of 6 GPa at room temperature and 423 K for 2 and 10 turns with a rotation speed of 1 rpm. For the HPS process, sheet samples with 10-30mm width, 100mm length and 1mm thickness were prepared and processed under a pressure in the range of 1.5-5 GPa at room temperature with high-strength Al alloys (A2024 and A7075), a Ti alloy (F1295) and a Ni-based superalloy (Inconel718) including an AZ61 Mg alloy [4]. Transmission electron microscopy revealed that the grain size is reduced to the submicrometer levels. Tensile testing confirmed that all processed samples exhibited superplasticity with total elongations more than 400%.

It should be noted that the introduction of large plastic strain was feasible without breaking the samples despite processing at room temperature and this is due to the application of high applied pressure during the processing.

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