홈프레싱 공정에서의 소성변형 국부화

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Severe plastic deformation (SPD) is a well developed process for grain refinement in bulk metals and alloys to submicron or ultrafine grain (UFG) level. There are several SPD techniques that have been investigated, like equal channel angular pressing (ECAP), high pressure torsion, equal channel angular rolling, accumulative roll bonding, and groove pressing (GP), to obtain fine grains in the bulk materials. ECAP is one of the most promising and commonly applied SPD process for bulk materials in the form of rods or bars. But GP is a challenging method for producing UFG microstructures in sheet metals.

In the present study, simulations of GP were carried out in five stages. The specimen was pressed between two grooved dies in the first stage. During the second stage, the pressed specimen was flattened/straightened by using two flat dies, shown in Fig. 1b. In the third stage shown in Fig. 1c the top die was shifted towards right hand side (RHS) about one groove length (equivalent to width of the groove~ 5 mm, where the undeformed regions are deformed in the next stage). The fourth and fifth stages are the repetition of first and second stages, in which the flattened specimen during second stage was pressed between two grooved dies and flattened again by using two flat dies, respectively. In earlier studies of GP the specimen was rotated 180o in the plane of pressings. These five stages (two groove pressings, two flattens and top die shifting) comprise one cycle/pass. A groove angle of 45° was used in the present study. The GP process has several advantages, such as UFG microstructures in metals and its applicability to thin sheet materials, which cannot be applied to the most widely used SPD processes like ECAP.

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