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Production of High Strength Materials Using High-Pressure Torsion

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論　文　要　旨

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論文題名

Production of High Strength Materials Using High-Pressure Torsion
高圧ねじり変形加工による高強度材開発に関する研究

論　文　内　容　の　要　旨

In the investigation of this thesis, the bcc structured refractory metals of 5th and 6th groups in the periodic table, V^{23}, Cr^{24}, Nb^{41}, Mo^{42} and Ta^{73} are subjected to high-pressure torsion (HPT) process at room temperature to produce ultrafine/nano structures. The evolution of microstructures and mechanical properties is investigated at different processing conditions. It is shown that the hardness and the mechanical properties of pure bcc refractory metals processed by HPT are significantly increased with ultrafine structures. Also, simultaneous strengthening from both grain refinement by HPT process and post aging is attempted in Al alloys and an FeNi alloy. In an Al-Li alloy and Al-Ag alloys, Vickers microhardness is increased after HPT process due to the generation of an ultrafine structure. Also, they are strengthened by the formation of fine precipitates during the subsequent aging process. Particularly, the Al-Ag alloys show higher strength and higher ductility at peak aging than the as-HPT processed specimens. The FeNi alloy is processed by HPT and annealed at lower homologous temperatures. Vickers microhardness and microstructural evolutions are examined with respect to the annealing time. Microstructure analysis using XRD revealed that there is a peak corresponding to α-Fe after the annealing for 40 days. This was also confirmed with high-energy X-ray analysis using the synchrotron light facility.