계면편석 억제와 미세구조 조절에 의한 중합금의 기계적성질 향상

Suppression of Interfacial Segregation and Control of Microstructure for Improvement of Mechanical Properties of W-Ni-Fe Heavy Alloy

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In mechanical testing of W-Ni-Fe heavy alloys, the cracks nucleate at W/W interface and propagate through W/matrix interface or through matrix phase together with the cleavage of W grains. The mechanical properties can therefore be improved by control of the interfacial strength and area. In this presentation, some experimental result and techniques on this subject will be reviewed and discussed. The hydrogen embrittlement caused by the hydrogen segregation at interfaces during sintering in an hydrogen atmosphere can be removed by an heat-treatment in vacuum or in an inert atmosphere. The heat-treatment condition can be estimated by using a diffusion equation for a cylindrical shape. The mechanical properties, in particular the impact property, are degraded by the segregation of non-metallic impurities, such as S and P. The degradation can be prevented by adding a fourth element, such as La or Ca, active with the non-metallic impurities. The cyclic heat-treatment at usual heat-treatment temperature causes the penetration of matrix between W/W grain boundaries and results in remarkable increase in impact energy. This is due to an increase in the area of ductile failure during the impact test. The instability of W/matrix interface casued by addition of Mo or Re can be controlled by using W powders of different size. The increase in the interfacial area in found to be related to the presence of non-equilibrium pure W grains among W(Mo or Re) solid solution grains.