New Functional Co-base Alloys
– Phase Stability and Its Industrial Applications –

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【Outline of survey】
Co-base alloys have been widely used as corrosion / erosion resistant, high-temperature magnetic and biomedical materials. However, the phase diagrams which are the basic information necessary for the development of advanced Co-base alloys have not been studied as extensively as in other alloy systems. Therefore, the purpose of the proposed study is to examine the phase equilibria of Co-base alloys experimentally as well as by thermodynamic analysis with the aim of constructing a thermodynamic database for the Co-base alloy system. Based on phase diagram research, the following studies will be conducted to develop new functional Co-base alloys.

(1) Co-base superalloys: Our group recently found a new γ’ phase Co₃(Al, W) with L1₂ structure which exhibits inverse temperature dependence of flow stress as well as the γ’phase, Ni₃Al in the Ni-base superalloys. Therefore, the present study will be focused on the microstructural evolution, mechanical properties and other high temperature characteristics to develop a new type of Co-base superalloys.

(2) Magnetic recording media: Co-Cr-base sputtered films have been used for high- density magnetic recording media. Co-Cr-base film is made up of Co-rich ferromagnetic hcp nanosized grains surrounded by a Co-poor paramagnetic hcp phase, which is attributed to magnetically induced phase separation. Since a similar phase separation appears in the Co-Mo and Co-W-base alloys, the microstructure, magnetic properties and optimum sputtering conditions will be studied.

(3) Medical device: Based on preliminary investigation of the formation of the second phase in the Co matrix and removal of the phase in the surface by a chemical or physical method, Co-base porous metals will be prepared to develop a new type of drug eluting vascular stent.

【Expected results】
The construction of a thermodynamic database for the Co-base alloy system can be expected to be a powerful tool for utilization not only in the development of commercial Co-base alloys but also for the development of advanced materials. Furthermore, the research on (i) Co-base superalloys (ii) magnetic recording media and (iii) drug eluting stent will be conducted utilizing a new process developed by the present group. In particular, it is expected that the development of Co-base superalloys will result in the reduction of CO₂.

【References by the principal investigator】

【Term of project】 FY2007－2011
【Budget allocation】 27,400,000 yen
(2007 direct cost)

【Homepage address】 http://www.material.tohoku.ac.jp/ip/labs/metal03.html