

Cobalt-Based High-Temperature Alloys

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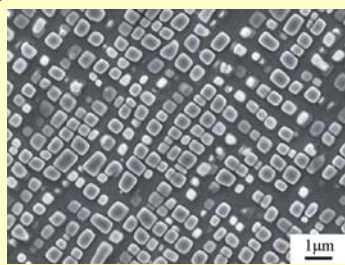
1. Beyond Ni-based Superalloys

- Co-based alloys' properties as superalloys candidate (compared to Ni-based superalloys)

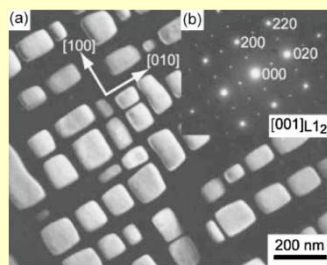
- Higher melting point ... favorable
- Lower strength ... unfavorable

↓ Precipitation hardening of matrix by ordered phase is necessary as in the case of Ni-based superalloys.

- $\gamma+\gamma'$ phase in Co-Al-W was discovered
Co-Al-W superalloys

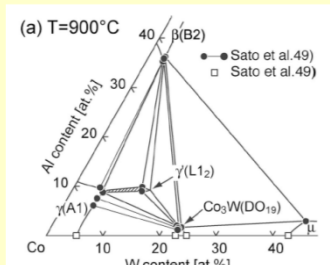


Phase of Newly developed Co-Al-W alloys



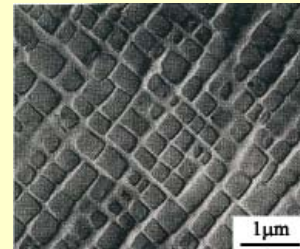
Precipitated phase was confirmed as γ' phase

Base Element	Melting Point (K)	Superalloys	Crystal Structure of Superalloys	
Nickel (Ni)	1,728	Ni-Al-Ti	matrix	γ (FCC)
			Ordered phase	γ' (Ni ₃ (Al,Ti) with L ₁₂ structure)
Cobalt (Co)	1,768	Co-Al-W (this study)	matrix	γ (FCC)
			Ordered phase	γ' (Co ₃ (Al,W) with L ₁₂ structure)



Phase diagrams of the Co-Al-W ternary system

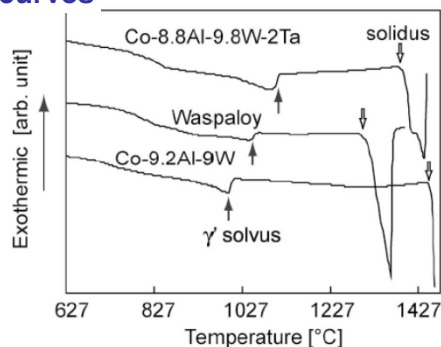
Ni-based superalloys



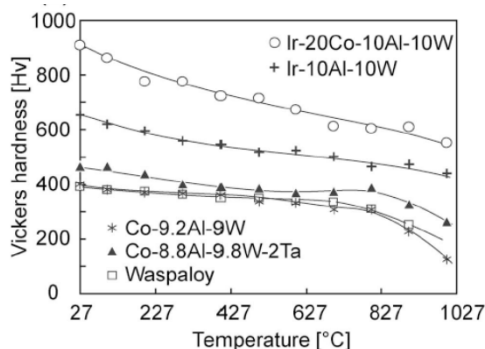
$\gamma+\gamma'$ phase in Ni-based superalloys for comparison

2. Properties of New Alloys

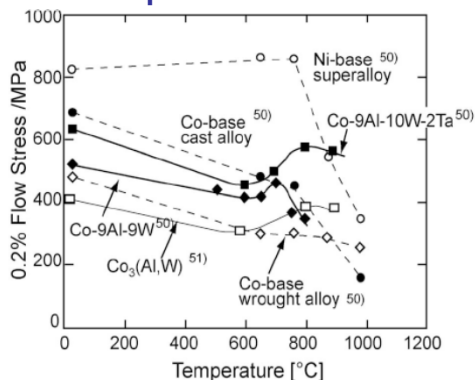
(a) DSC curves



(b) Vickers Hardness of various alloys



(c) Temperature dependence of 0.2% Flow Stress



3. Application Examples

(1) High hot-workability



Hot rolling at 1,250°C



(2) Application to a Friction-Stir-Welding tool



Before Welding



After Welding



Welded Sample (Two Ti plates are welded)

4. Patent available for licensing

Patent No. : WO2007/032293, WO2007/091576
(JP,US,EP,CN,CA)

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