

# Al-Ni-Ta-V (Aluminum-Nickel-Tantalum-Vanadium)

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Several polyphase eutectic alloys with a metallic phase and one or more ordered intermetallics in the microstructure were examined by [1995Joh] in an effort to obtain a good combination of room-temperature toughness and high-temperature strength. The characteristics of the NiAl-NiAlTa-V eutectic mixture of this quaternary system were studied in this connection.

## Binary Systems

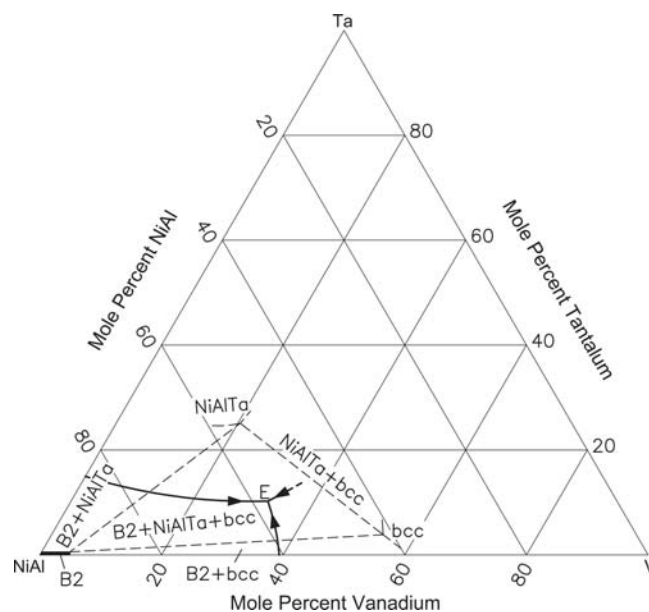
For brief descriptions of the Al-Ni, Al-Ta, and Ni-Ta phase diagrams, see the Al-Ni-Ta update in this issue. See [2005Rag] for descriptions of the Al-V and Ni-V phase diagrams. The Ta-V phase diagram [Massalski2] depicts a continuous body-centered-cubic solid solution between Ta and V. An intermediate phase  $V_2Ta$  forms below 1310 °C and has the  $MgCu_2$ -type cubic structure.

## Ternary Systems

An update on the Al-Ni-Ta system appears in this issue. The update of the Al-Ni-V system by [2005Rag] includes partial isothermal sections at 1300 and 1200 °C and a vertical section along the  $Ni_3Al-Ni_3V$  join. The compilation of [1995Vil] presented an isothermal section at 1000 °C for the Al-Ta-V system. The Ni-Ta-V system reviewed by [1991Gup] reported the lack of phase diagram data in the system.

## Quaternary Phase Equilibria

Using high-purity Al, Ni, Ta, and V metals, [1995Joh] prepared alloy compositions by induction and arc melting. By metallographic examination, four compositions were bracketed to yield the maximum volume fraction of the eutectic mixture. The microstructure of the directionally solidified alloy showed vanadium-rich dendrites surrounded by cells or colonies of the ternary eutectic of NiAl-NiAlTa-V. The tentative liquidus projection constructed by [1995Joh] is shown in Fig. 1 on a triangular section of the composition



**Fig. 1** Al-Ni-Ta-V partial liquidus projection on the NiAl-V-Ta plane [1995Joh]

tetrahedron obtained by joining NiAl to Ta and V corners. The phase distribution at the undetermined eutectic temperature is shown schematically in Fig. 1. E is the composition of the eutectic liquid.

## References

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- 1995Joh:** D.R. Johnson, B.F. Oliver, R.D. Noebe, and J.D. Whittenberger, NiAl-Based Polyphase in situ Composites in the NiAl-Ta-X (X = Cr, Mo, or V) Systems, *Intermetallics*, 1995, **3**, p 493-503
- 1995Vil:** P. Villars, A. Prince, and H. Okamoto, Al-Ta-V, *Handbook of Ternary Alloy Phase Diagrams*, Vol 4, ASM International, 1995, p 4360-4364
- 2005Rag:** V. Raghavan, Al-Ni-V (Aluminum-Nickel-Vanadium), *J. Phase Equilibria*, 2005, **26**(3), p 273-275